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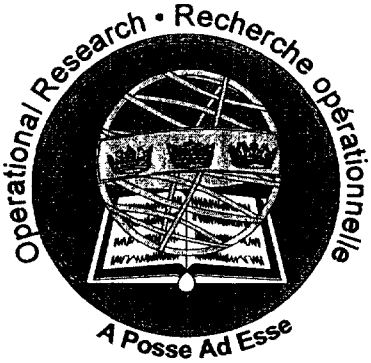

OPERATIONAL RESEARCH DIVISION

DIRECTORATE OF OPERATIONAL RESEARCH (MARITIME, LAND & AIR)

DOR(MLA) RESEARCH NOTE RN 2003/03

THE ORD CAEn DATABASE DOCUMENTATION v2.0 VOLUME I – UNITS, WEAPONS, SENSORS AND AMMUNITION

BY

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MAY 2003

OTTAWA, CANADA

National Defence Défense nationale

OPERATIONAL RESEARCH DIVISION

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Recommended by: for G L Christopher, LFORT

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Directorate Research Notes are written to document material which does not warrant or require more formal publication The contents do not necessarily reflect the view of ORD or the Canadian Department of National Defence

OTTAWA, ONTARIO MAY 2003

ABSTRACT

This publication contains the documentation for the ORD CAEn Version 2.0 unclassified database. It includes all the notes, assumptions, methodology and references relevant to the development of the Version 2.0 database for versions 2, 3, 5.1 and 8.1 of the British-developed CAEn simulation software. CAEn has military and civilian components. However, this documentation supports only the database for the military component of the CAEn software.

RÉSUMÉ

Cette publication contient la documentation pour la base de données canadienne non-classifiée version 2.0 de CAEn DRO. Elle comprend toutes les notes, hypothèses, méthodologie et références relatives au développement de cette base de données pour les versions 2, 3, 5.1 et 8.1 du logiciel de simulation britannique CAEn. Le logiciel possède à la fois une composante militaire et civile. Cependant, le présent document traite uniquement de la base de données de la composante militaire de CAEn.

USER ADVISORY

This document supersedes DOR (J&L) Research Note, RN 9908 dated February 1999 and entitled:

THE ORD CAEn DATABASE DOCUMENTATION version 2.0
VOLUME I - UNITS, WEAPONS, SENSORS AND AMMUNITION

This document has been revised to include new parameters or features in the military database of CAEn versions 5.1 and 8.1. It also updates various parts of RN 9908 based on receipt of additional material that either provides clarification or supplements information contained in various parts of the previous research note.

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LIST OF ABBREVIATIONS

AFV	Armoured Fighting Vehicle
APC	Armoured Personnel Carrier
APDS-T	Armour Piercing Discarting Sabot Tracer
APFSDS	Armour Piercing Fin Stabilized Discarding Sabot
AP-T	Armour Piercing –Tracer
AT	Anti-Tank
ATGM	Anti-Tank Guided Missile
AZ	Azimuth
CAEn	Close Action Environment
DERA	Defence Evaluation and Research Agency
DPICM	Dual Purpose Improved Conventional Munition
Dstl	Defence science and technology laboratory
ERA	Explosive Reactive Armour
FIBUA	Fighting in built-up areas
FOO	Forward Observation Officer
FOV	Field of View
GPMG	General-Purpose Machine Gun
GUI	Graphical User Interface
HC	Hexachloroethane-zinc smoke mixture
HE	High Explosive
HEAT AP	High Explosive Anti-Tank Armour-Piercing
HE-FRAG	Fragmentation High Explosive Shell
HE-I	High Explosive-Incendiary
HE-RAP	High Explosive-Rocket Assisted Projectile
HESH	High Explosive Squash Head
HE-T	High Explosive-Tracer
HMG	Heavy Machine-Gun
ICM	Improved Conventional Munitions
IDF	Indirect Fire
IFV	Infantry Fighting Vehicle
II	Image Intensifier
LEO	Leopard Tank
LMG	Light Machine-Gun
LOS	Line of Sight
MFC	Mortar Fire Controller

MLA	Maritime, Land, Air
MRTD	Minimum Resolvable Temperature Difference
MTF	Modulation Transfer Function
NAPC	New Armoured Personnel Carrier
NCOs	Non-Commissioned Officers
NODLR	Night Observation Device Long Range
SRAAW(H)	Short Range Anti-Armour Weapon (Heavy)
SRAAW(L)	Short Range Anti-Armour Weapon (Light)
SRAAW(M)	Short Range Anti-Armour Weapon (Medium)
SSKP	Single-Shot Kill Probability
TI	Thermal Imagery
TUA	Tow under Armour
TTPs	Tactics, Techniques and Procedures
WP	White Phosphorous

ORD CAEn
DATABASE DOCUMENTATION V2.0
VOLUME I – UNITS, WEAPONS, SENSORS AND AMMUNITION

CHAPTER I - INTRODUCTION

1. The CAEn (Close Action Environment) model is a war-game simulation, which has been acquired for use within the Directorate of Operational Research (Maritime, Land, Air) (DOR (MLA). This simulation was developed by the Defense science and technology laboratory (Dstl), formerly the Defence Evaluation and Research Agency (DERA), part of the British Ministry of Defence. The Operational Research Division (ORD) views CAEn as one in a set of simulations that will be used to investigate infantry close-combat studies. These future projects will assist the Canadian Army in determining what new types of protective clothing, vehicles, weapons, sensors and ammunition will be required for the Army of the future. The simulation can also be used to investigate small unit tactics, techniques and procedures (TTPs).

2. As one of the initial steps in preparing the simulation for use it was decided to develop a Canadian unique database, which reflects the soldier's protective clothing, vehicles, weapons, sensors and ammunition in use by the Canadian Army as of January 1998. New equipment and ammunition types will be added to the database based on future study requirements. Likewise a range of threat force weapons, vehicles, sensors and munitions have been included. These allow for the modelling of a threat force that ranges from a first class, modern enemy to a less sophisticated force that might be encountered in operations other than war.

3. In developing the database, a conscious decision was made to directly link it to the ORD Janus simulation database (a proven, reliable and highly developed database). Where possible, Janus nomenclature and data have been used for the CAEn database.

4. This documentation contains detailed notes describing RED and BLUE CAEn units included in the database, as well as information notes on each major CAEn data file. Canadian wargaming experience has shown that it is critical to establish verified, validated and documentated data for such war-game simulations. These provide credibility, transparency and continuity over the many studies and among the many users. This document serves such a function for the CAEn war-game simulation tool. It explains:

a. the basis on which certain assumptions were made;

b. the methodology used to generate various data values; and

c. the procedure used to select a specific data value in cases where conflicting or different values were available.

5. The CAEn Unit Notes also contain a listing of all reference sources by name and page number for the data used for all units, weapons, sensors and ammunition in the database. Only unclassified data sources were used.

6. Additional volumes to this database documentation are also planned. Future volumes will include information and descriptive notes concerning CAEn Behaviour Data Files with regard to Activities files and Group Tactics files.

7. With the receipt of CAEn version 5.1 (which contains two components, a military model and a civilian model), there have been several additions and changes to various indexes, formats and parameters in the unit, weapon, sensor and ammunition data files. With regard to the civilian model, the ORD has decided not to implement the civilian component of the simulation now. Only those parts of the database with regard to the military component will be amended or updated as required.

8. The actual data used in the database is not all included with this documentation. It is planned that, as time and resources permit, the data will be printed as an additional volume to this documentation. However, the data can be requested by contacting the CAEn Project Leader as indicated below.

9. Comments and queries concerning this documentation are welcomed and should be addressed to the ORD CAEn Project Leader, Mrs Mélanie Bernier:

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10. Lastly, the database developers would like to thank the members of the British CAEn development team for answering our many queries concerning the database construction and for defining and explaining the function of the CAEn parameters. It is hoped that this documentation will be of use to other members of the CAEn community.

CHAPTER II - UNIT DESCRIPTIONS AND ASSUMPTIONS

11. This chapter provides an overview of each of the units in the CAEn database. Users are reminded that there are four unit types in the CAEn database: tanks, APCs, infantry and helicopters. It also includes indirect fire systems (artillery or mortars). This section details any specific assumptions that were made to model each unit. CAEn is limited to a maximum of 200 units, which can be allocated in any numerical combination split between RED and BLUE units. The current database contains a total of 64 units with 31 BLUE units and 33 RED units. Each unit is assigned a Unit Number, followed by a list of facts and specific assumptions pertaining to the unit. Lastly, a listing of the references from which data has been extracted for each unit is included. These unit notes should also be read in conjunction with the general notes for the CAEn Unit Data Files, as well as Annex I, which is a summary of all units, weapons, sensors and ammunition in the CAEn database.

12. In order to reduce the total number of sensors in this initial Canadian version of the CAEn database, all RED dismounted anti-tank guided missile systems have no thermal sight capability. This capability can be included in future versions of the database to meet specific study requirements. In a similar fashion, the number of sensors on some vehicles has been limited or rationalized to keep the total number of sensors to a reasonable number. For example all RED tanks, regardless of the type of tank and the sensors it really has, have the same suite of unit and weapons sensors with the exception of the Red T-72B1 tank, which has no thermal sight. Likewise the numbers of unit and weapon sensors on BMP1, 2 and 3 have been limited and not all sensors on these vehicles have been included.

13. Ammunition loads have been adjusted in some areas, mainly because there is limited functionality in CAEn to upload ammunition or transfer ammunition. For example, where a unit may have more than one weapon of the same type, only one of these weapons is included on the unit but the ammunition load for all the weapons of that type has been given to the one weapon. Units that have auto loaders with a fixed number of rounds in the carousel have been given the complete load of ammunition stowed on the unit - that is - rounds in the carousel and additional rounds stowed elsewhere in the unit.

14. **Unit 1. Blue 60 mm mortar.**

a. Man-portable USA 60 mm.

b. M19 mortar modelled.

c. Fires the C11OHE round (which is similar to the M49A5 HE round), the M302A2 WP smoke round and M83A3 illuminating round.

d. Unit uses Sensor 1, Eyeball.

e. Unit movement rates are slightly lower than those of Unit 9, a Blue infantryman, to reflect the carriage of the mortar and ammunition.

f. The unit represents one infantryman of the two-man crew but some of the unit dimensions have been increased to account for the size of the mortar and ammunition carried. The crew is armed with C7 rifles and is capable of throwing grenades.

g. Unit is considered to be loaded with one round, which can be fired as soon as the simulation is running.

h. Unit is the equivalent of Janus system 13.

i. References:
   i. Ref 3, p 397 and p 566 for ammo.
   ii. Ref 4, pp 405-406.
   iii. Ref 5, Janus database.
   iv. Ref 16, British functional data.
   v. Refs 6 and 9, for ballistic data.

15. **Unit 2. Blue 81 mm mortar.**

a. Man-portable over limited distances.

b. British L16A1 mortar modelled with L5A5 mounting system.

c. Fires M374A3 HE, the M375A2 WP smoke and M301A3 Illuminating rounds.

d. Uses Sensor 2, Null – IDF.

e. Man-portable but movement rates are significantly slower than for Unit 9, Blue Infantryman.

f. Three-man firing crew with unit dimensions slightly less than the sum of the dimensions for three individual infantrymen. Infantrymen have not been given the capability to throw grenades.

g. Unit considered being loaded with one round at simulation start.

h. Unit is the equivalent of Janus system 14.

i. References:

i. Ref 3, pp 396-397.
ii. Ref 4, pp 433-435 for ammo.
iii. Ref 5, Janus database.
iv. Refs 6 and 9 for ballistic data.
v. Ref 11, p 94.
vi. Ref 16, British functional data used.

16. **Unit 3. Blue 120 mm mortar.**

a. Not modelled as being man-portable but can be mounted in an M113A3 APC.

b. M121 mortar modelled.

c. Fires RR 14HE that is similar to the M98 HE as well as M57 smoke and M3 illuminating rounds.

d. Uses CAEn unique Sensor 2, Null_IDF.

e. Unit Speeds, because of the nature of the CAEn database, are based on Unit 9, Blue

infantryman. Note that larger calibre indirect fire weapons will, in most CAEn scenarios, not likely be moved from their original position at the start of the scenario. Follows convention in British CAEn database.

f. Unit dimensions are those of the three man firing crew with dimensions slightly less than the sum of the dimensions for three individual infantrymen.

g. Unit considered being loaded with one round at simulation start.

h. Unit is the equivalent of Janus system 16.

i. References:

i. Ref 3, pp 400-401.

ii. Ref 4, pp 458-460 and Ref 11, p 104 for ammo.

iii. Ref 5, Janus database.

iv. Refs 6 and 9, for ballistic data.

v. Ref 16, British functional data.

17. **Unit 4. Blue LG1 Howitzer.**

a. Giat Industries 105 mm LG1MK11 Light Gun modelled.

b. Fires C132HE, which is similar to the HE M1 round as well as M84A1 HC smoke rounds and the C103 illuminating round which is similar to the M314A3 illuminating round. All rounds manufactured in Canada. Can use ICM ammunition but none in database at this time.

c. Unit length is taken as the length of the unit when it is deployed for firing while sensor height is estimated.

d. Uses CAEn unique Sensor 2, NULL_IDF.

e. Speeds as per note d for Unit 3.

f. Unit considered being loaded with one round at simulation start.

g. Unit is the equivalent of Janus system 12.

h. References:

i. Ref 1, pp 660 - 661.

ii. Ref 3, pp 244, 252 and 254 for ammunition.

iii. Ref 5, Janus database.

iv. Refs 6 and 9, for ballistic data.

v. Ref 16, British functional data.

18. **Unit 5. Blue 105 C3 Howitzer.**

a. C1 (M1A1) towed howitzer modelled using the British RDM Technology M101/33 calibre upgrade.

b. Unit dimensions data could only be located for the unit in the travelling position. Sensor height is estimated. For purposes of this database, Unit 5 fires same ammunition as Unit 4.

c. Uses CAEn unique Sensor 2, NULL_IDF.

d. Speeds as per note d for Unit 3.

e. Unit is the equivalent of Janus system 1.

f. Unit considered being loaded with one round at simulation start.

g. References:

i. Ref 1, pp 676 - 677.

ii. Ref 3, pp 244, 252 and 254 for ammunition.

iii. Ref 5, Janus database.

iv. Refs 6 and 9, for ballistic data.

v. Ref 16, British functional data.

19. **Unit 6. Blue 105 M1A1 Howitzer.**

a. USA 105 mm Howitzer M101 modelled.

b. Fires same ammunition as Unit 4.

c. Unit dimensions data reflect dimensions in firing position for height and width and travelling position for length. Sensor height estimated.

d. Speeds as per note d for Unit 3.

e. Uses CAEn unique Sensor 2, NULL_IDF.

f. Unit considered being loaded with one round at simulation start.

g. Unit is the equivalent of Janus system 8.

h. References:

i. Ref 1, pp 716-717.

ii. Ref 5, Janus database.

iii. Refs 6 and 9, for ballistic data.

iv. Ref 16, British functional data.

20. **Unit 7. Blue M109A3/A4 Howitzer.**

a. USA M109 A3 modelled.

b. Fires M107 HE, BE M116 HC smoke (same as US M116 A1 and B1) and M485A2 illumination rounds, all manufactured in Canada. Can fire M483A1 DPICM ammunition but none in database at this time.

c. Unit dimensions taken from Ref 1 p 624 except for length, which is taken from Ref 1 p 585 and sensor height is estimated. Length includes only the hull and does not include length of barrel beyond hull.

d. Uses CAEn unique Sensor 2, NULL_IDF.

e. Unit considered being loaded with one round at simulation start.

f. Speeds as per note d for Unit 3.

g. Unit is the equivalent of Janus system 2.

h. References:

i. Ref 1, p 585 and p 624.

ii. Ref 4, pp 291-292, p 306 and pp 308-309 for ammunition.

iii. Ref 5, Janus database.

iv. Refs 6 and 9, for ballistic data.

v. Ref 16, British functional data.

21. **Unit 8. Blue commander.**

a. Generic unit that represents any level of commander from section/detachment commander to company/battalion commander.

b. Unit is armed with a 5.56 C7 rifle which fires C77 rounds and is capable of throwing grenades of any type. Rifle is loaded with a 30-round magazine at simulation start. Unit carries 3 smoke grenades.

c. See notes on Unit Data Files for explanation of unit dimension measurements.

d. Unit has two sensors:

i. Sensor 1, Eyeball.

ii. Sensor 3, X7 Binoculars.

e. No communication devices included.

f. Unit is wearing in-service Canadian combat clothing, webbing and new helmet as per operations in a summer temperate climate.

g. Unit speeds have been estimated for a summer temperate climate.

h. Unit is the equivalent of Janus systems 197, 198 and 199.

i. References:

i. Ref 5, Janus database.

ii. Actual measurements of dimensions of a soldier in various postures.

iii. Ref 17, Appendices 2 and 3 for equipment and ammunition carried by unit.

iv. Ref 28 for weapon and ballistic data.

22. **Unit 9. Blue rifleman without M72 anti-armour weapon.**

a. Armed same as Unit 8 (see Note a), but carries 4 HE and 4 smoke grenades.

b. Has only one sensor: Sensor 1, Eyeball.

c. Notes b, d, e and f for Unit 8 apply.

d. Unit is the equivalent of Janus system 188.

e. References same as for Unit 8.

23. **Unit 10. Blue Rifleman with an M72 anti-armour weapon.**

a. Unit is armed with a 5.56 C7 rifle (See Unit 8, Note a) and an M72 anti-armour weapon. Also possesses capability to throw any type of grenade.

b. Unit has only one sensor: Sensor 1, Eyeball.

c. Notes b, d, e and f for Unit 8 apply.

d. Unit is the equivalent of Janus system 194.

e. References:

i. Same as for Unit 8.

ii. Ref 3, pp 335-336 for data on M72.

24. **Unit 11. Blue C9 Gunner.**

a. Unit is armed with the 5.56 C9 Light Machine Gun, which is loaded with a 200 round drum of ammunition at simulation start. Unit is also capable of throwing any grenade. Spread among the rifle section is another seven (7) drums of ammunition. For this database, Unit 11 carries all seven.

b. Unit has one sensor: Sensor 1, Eyeball.

c. Notes b, d, e and f for Unit 8 apply.

d. Unit is the equivalent of Janus system 190.

e. References:
   i. Same as for Unit 8.
   ii. Ref 3, pp 237-238 for data on the C9 LMG.
   iii. Ref 4, p 8 for ammunition.

25. **Unit 12. Blue Grenadier.**

a. Blue rifleman with an M203 Grenade Launcher attached to his 5.56 C7 rifle.

b. Unit armed with a 5.56C7 rifle with an M203 40mm Grenade launcher attached underneath the rifle barrel.

c. Unit has only one sensor: Sensor 1, Eyeball.

d. Notes b, d, e and f for Unit 8 apply.

e. According to Ref 17, Appendix 2, the Grenadier carries 24 grenades while an additional 12 grenades are carried on another soldier. For this database the grenadier carries all 36 rounds because there is no way to share or supply ammo while the CAEn simulation is running.

f. Unit is the equivalent of Janus system 59.

g. References:
   i. Same as for Unit 8.
   ii. Ref 3, p 222 for data on the M203 launcher;
   iii. Ref 4, p 498 for ammunition data and
   iv. Ref 11, p 224 for ballistic data.

26. **Unit 13. Blue ERYX Gunner.**

a. Blue infantryman armed with an ERYX anti-tank guided weapon.

b. Unit is armed with a 5.56C7 rifle and a SRAAW(H) ERYX anti-tank guided missile. A total of 3 missiles are carried for each ERYX. For this database all missiles are carried by this unit.

c. Unit has only one sensor: Sensor 1, Eyeball.

d. Notes b, d, e and f for Unit 8 apply.

e. Unit is the equivalent of Janus system 207

f. References:
   i. Same as for Unit 8
   ii. Ref 3, p 316 for data on the ERYX

27. **Unit 14. Blue C6 Gunner.**

a. Blue infantryman armed with a 7.62 C6 general-purpose machine gun (GPMG).

b. Unit is capable of throwing all types of grenades but usually carries two smoke grenades. For this database all ammunition for this unit that usually is distributed among Platoon headquarters personnel is carried by this unit.

c. Unit has only one sensor: Sensor 1, Eyeball.

d. Notes b, d, e and f for Unit 8 apply.

e. Unit is the equivalent of Janus system 193.

f. References:

i. Same as for Unit 8

ii. Ref 3, pp 235-236 for data on GPMG

iii. Ref 27, pp 1-10, 2-58 and 4-188

28. **Unit 15. Blue sniper.**

a. Blue infantryman specially trained as a sniper.

b. Unit armed with the 7.62 mm C3A1 Sniper Rifle, which includes Sensor 6, a x10 telescope sight. Unit capable of throwing all types of grenades. Unit carries a total of 60 rounds of 7.62 ammunition.

c. Unit has only one sensor: Sensor 1, Eyeball.

d. Notes b, d, e and f for Unit 8 apply.

e. Unit is the equivalent of Janus system 185.

f. References:

i. Same as for Unit 8

ii. Ref 3, p 124 for data on the C3A1 Sniper Rifle

29. **Unit 16. Blue HMG Gunner.**

a. Blue infantryman trained as an HMG gunner.

b. Blue infantryman armed with a 5.56 mm C7 rifle and a 12.7 mm heavy machine gun. Gunner is part of a two-man team sharing the carriage of gun and ammunition. Gunner is assumed to carry five 30 round 5.56 mm magazines but not the 100 round bandoleer. No C44 armour piercing 12.7 mm ammunition has been modelled. Gunner has not been given capability to throw grenades.

c. Unit and weapon use Sensor 1, Eyeball.

d. Notes b, d, e and f for Unit 8 apply but speeds have been reduced to reflect weight of weapon and ammunition.

e. Unit is the equivalent of Janus system 201.

f. References:

i. Same as for Unit 8

ii. Ref 3, pp 277-278 for data on HMG

30. **Unit 17. Blue CARL GUSTAV Gunner.**

a. Blue infantryman specially trained to fire the CARL GUSTAV (CARLG) anti-tank weapon.

b. Blue infantryman armed with a 5.56 mm C7 rifle and a 84 mm CARL GUSTAV anti-tank weapon, SRAAW(M). Unit is also capable of throwing all types of grenades. Weapon has Sensor 8. Unit carries four smoke grenades.

c. Unit has only one sensor. Sensor 1, Eyeball.

d. Notes b, d, e and f for Unit 8 apply.

e. Unit is the equivalent of Janus system 191.

f. References:

i. Same as for Unit 8,

ii. Ref 3, pp 329-330 for data on CARLG

iii. Ref 4, pp 144-145 for data on ammunition.

31. **Unit 18. Blue FOO.**

a. Represents artillery FOO or an infantry mortar fire controller (MFC) who is capable of calling for and adjusting indirect fire.

b. Unit is armed with a 5.56 mm C7 rifle. Unit is also capable of throwing all types of hand grenades. Unit carries four HE and four smoke grenades.

c. Unit has three sensors:
   i. Sensor 1, Eyeball;
   ii. Sensor 3, X7 binoculars;
   iii. Sensor 20, NODLR Thermal Imaging Device.

d. No communications means are modelled in the CAEn database.

e. Notes b, d, e and f for Unit 8 apply.

f. Unit is the equivalent of Janus system 187.

g. References: same as for Unit 8.

32. **Unit 19. Blue recce detachment member.**

a. This is a generic type of soldier who can represent infantry or armour crewman specially trained for recce tasks.

b. Unit is armed with a 5.56 mm C7 rifle. Unit is capable of throwing all types of hand grenades but usually carries only six smoke grenades.

c. Unit has two sensors:
   i. Sensor 1, Eyeball
   ii. Sensor 3, X7 binoculars.

d. No communications means modelled.

e. Notes b, d, e and f for Unit 8 apply.

f. Unit is the equivalent of Janus systems 192, 203 and 213.

g. References: same as for Unit 8.

33. **Unit 20. Blue observation detachment member.**

a. Can represent infantry or armour crewman specially trained for both recce and observation tasks.

b. All notes for Unit 19 apply except that unit has the following three sensors:
   i. Sensor 1, eyeball;
   ii. Sensor 3, X7 binoculars;
   iii. Sensor 20, NODLR Thermal Imaging Viewer.

34. **Unit 21. Blue LEOPARD C1.**

a. Current LEOPARD C1 battle tank modelled.

b. Unit is armed with a 105 mm main tank gun and a 7.62 mm coax machine gun. Main gun fires the DM 63 APFSDS round which is similar to the TAAS M426 APFSDS round and the 105 HESH-TL35 round. The integral smoke grenade dischargers and manifold producing smoke have not been modelled.

c. Unit has the following sensors:
   i. Sensor 1, Eyeball.
   ii. Sensor 4, Vision blocks.
   iii. Sensor 3, X7 binoculars.
   iv. Sensor 16, X4 LEO sight (commander).

d. The tank gun has the following weapon sensors:
   i. Sensor 17, x14 LEO sight (gunner)
   ii. Sensor 18, LEO II sight.

e. Notes b, d and f for Unit 8 apply.

f. Unit is the equivalent of Janus system 101.

g. References:
   i. Ref 1, p 38 for general vehicle data.

ii. Ref 5, Janus database.
iii. Refs 4 and 11 for ammunition data.
iv. Refs 14 and 15 for sensor data.
v. Refs 25, from Half-track to Leopard2, technical tables sections.
vi. Refs 29 and 30 for ballistic data.

35. **Unit 22. Blue LEOPARD C2.**

a. Upgraded version of the LEOPARD C1 with improvements in armour protection and sensors to bring it up to German LEOPARD 1A5 standards.

b. Armed with the same weapons and fires the same ammunition as Unit 21, the LEOPARD C1. No "through the barrel missile" capability has been modelled but this could be included in a future database if required for study purposes.

c. Has the EMES 18 sighting system, which includes a thermal sight, Sensor 19. LEO II sight Sensor 18 has been eliminated but all other sensors remain as for Unit 21.

d. Armour protection is the same as that available on the LEOPARD C1 but also includes the MEXAS add-on armour.

e. Notes b, d and f for Unit 8 apply

f. Unit is the equivalent of Janus system 105.

g. References:
i. Ref 1, p 38 for general vehicle data
ii. Ref 5, Janus database.
iii. Refs 4 and 11 for ammunition data
iv. Refs 14 and 15 for sensor data.
v. Refs 25, from Half-track to Leopard2, technical tables sections.
vi. Refs 29 and 30 for ballistic data.

36. **Unit 23. Blue COUGAR.**

a. This is a six-wheeled lightly armoured vehicle, which can be used in recce or direct fire support roles.

b. Armed with a 76 mm L23A1 gun firing a 76 mm L29 HESH round and a 7.62 mm coax machine gun. Smoke grenade dischargers have not been modelled.

c. Unit has the following sensors:
   i. Sensor 1, Eyeball
   ii. Sensor 3, X7 binoculars
   iii. Sensor 4, Vision blocks
   iv. Sensor 11, X7 AFV sight.

d. Weapons have the following sensors:
   i. Sensor 14, x10 Cougar sight
   ii. Sensor 15, Cougar II sight.

e. Notes b, d and f for Unit 8 apply.

f. Unit is the equivalent of Janus system 132.

g. References:
   i. Ref 1, p395 for general vehicle data.
   ii. Ref 5, Janus database.
   iii. Refs 4 and 11 for ammunition data.
   iv. Ref 21, pp 629-630 and Ref 14 for sensor data.
   v. Ref 26 for general vehicle and weapon data

37. **Unit 24. Blue GRIZZLY.**

a. This is a six-wheeled, light-armoured APC, which carries a section of infantrymen.

b. Unit is armed with a 12.7 mm heavy machine gun and a 7.62 mm coax machine gun installed in a one-man turret. No C44 armour piercing 12.7 mm ammunition has

been modelled. No smoke dischargers have been modelled.

c. Unit uses three sensors:
   i. Sensor 1, Eyeball
   ii. Sensor 3, X7 binoculars
   iii. Sensor 4, Vision blocks.

d. Weapons have the following sensor: Sensor 12, X1.5 sight.

e. Notes b, d and f for Unit 8 apply.

f. Unit is the equivalent of Janus system 131.

g. References:
   i. Ref 1, p 395 for general vehicle information.
   ii. Ref 2, p 410 for data on the turret.
   iii. Ref 5, Janus database.
   iv. Refs 4 and 11 for ammunition data.
   v. Ref 2, p 410 and Ref 14 for sensor data.

38. **Unit 25. Blue BISON.**

a. This is an eight-wheeled, lightly armoured APC, which can carry an infantry section. Although not included in this database there is a version of the APC, which has an internal mounting for the installed 81 mm mortar.

b. Unit is armed with a 7.62 mm machine gun on a sliding mount; no smoke dischargers have been modelled.

c. Unit has three sensors:
   i. Sensor 1, Eyeball
   ii. Sensor 3, X7 binoculars
   iii. Sensor 4, Vision blocks.

d. The 7.62 mm machine gun uses Sensor 1, Eyeball.

e. Notes b, d and f for Unit 8 apply.

f. Unit is the equivalent of Janus system 125.

g. References:

i. Ref 1, pp 394-395 for general vehicle information.

ii. Refs 4 and 11 for ammunition data.

iii. Ref 5, Janus database.

iv. Refs 14 and 15 for sensor data.

39. **Unit 26. Blue New APC (NAPC).**

a. This is the new eight-wheeled APC for the Canadian Forces with a two-man turret. Vehicle carries an infantry section. Add-on armour can be installed on the vehicle to increase protection.

b. Unit is armed with a 25 mm chain gun cannon and a 7.62 mm coax machine gun. No smoke dischargers have been modelled.

c. Unit has four sensors:

i. Sensor 1, Eyeball

ii. Sensor 3, X7 binoculars

iii. Sensor 4, Vision blocks

iv. Sensor 11, X7 AFV sight which is the commander's wide field of view optical sight.

d. Weapons use sensors:

i. Sensor 11, X7 AFV sight

ii. Sensor 13, AFV TI sight.

e. Notes b, d and f for Unit 8 apply.

f. Unit is the equivalent of Janus systems, 134, 173 and 174.

g. References:

i. Ref 1, pp 484-486 for general vehicle information.

ii. Ref 2, pp 405-406 for turret data.

iii. Ref 5, Janus database.

iv. Refs 4 and 11 for ammunition data.

v. Ref 2, pp 629-630 for sensor data and Ref 14.

vi. Ref 33 for general vehicle, weapon and sensor data.

40. **Unit 27. Blue COYOTE.**

a. This is the new Canadian eight-wheeled recce vehicle. The version modelled is the one found in unit recce platoons instead of the version in brigade recce squadrons, which has a mast mounted sensor package.

b. Unit is armed with a 25 mm chain gun and a 7.62 mm coax machine gun. No smoke dischargers have been modelled.

c. The unit has four sensors:

i. Sensor 1, Eyeball

ii. Sensor 3, X7 binoculars

iii. Sensor 4, Vision blocks

iv. Sensor 11, X7 AFV sight.

d. Weapons on the unit use:

i. Sensor11, X7 AFV sight

ii. Sensor 13, AFV TI sight.

e. Notes b, d and f for Unit 8 apply.

f. Unit is the equivalent of Janus system 178.

g. References:

i. Ref 1, pp 847-848 for general vehicle data.

ii. Ref 2, pp 405-406 for turret data.

iii. Ref 2, pp 629-630 and Ref 14 for sensor data.

iv. Refs 4 and 11 for ammunition data.

v. Ref 5, Janus database.

41. **Unit 28. Blue M113 A3 APC.**

a. This is the standard M113 infantry carrying APC, which carries an infantry section with all its weapons and equipment.

b. Unit armed with a 12.7 pintle mounted .50 calibre heavy machine gun.

c. Unit has three sensors:

i. Sensor 1, Eyeball

ii. Sensor 3, X7 binoculars

iii. Sensor 4, Vision blocks.

d. Notes b, d and f for Unit 8 apply.

e. Unit is the equivalent of Janus system 120.

f. References:

i. Ref 1, pp 364-369.

ii. Ref 5, Janus database.

iii. Refs 4 and 11 for ammunition data.

iv. Refs 14 and 15 for sensor data.

42. **Unit 29. Blue TOW Under Armour (TUA).**

a. This is an M113A1 APC fitted with the Norwegian TOW turret.

b. The TOW turret has two launchers allowing two rounds to be loaded. Also attached to the turret is a 7.62 mm coax machine gun, which can be aimed with the units TI sight. A crew of four is modelled.

c. The unit has three sensors:

i. Sensor 1, Eyeball

ii. Sensor 3, X7 binoculars

iii. Sensor 4, Vision blocks.

d. The unit's weapon uses two sensors:

i. Sensor 9, X13 TUA optical sight

ii. Sensor 10, TUA TI sight.

e. Notes b, d and f for Unit 8 apply.

f. Unit is the equivalent of Janus system 138.

g. References:

i. Ref 1, p 308 for general vehicle data.

ii. Ref 2, p 419 for turret data.

iii. Ref 10, p 903 for ballistic data.

iv. Ref 5, Janus database.

v. Refs 4 and 11 for ammunition data.

vi. Refs 14 and 15 for sensor data.

43. **Unit 30. Red 82 mm mortar.**

a. Unit is man-portable over limited distances.

b. Unit fires HE, WP smoke and the M69 illuminating rounds.

c. Uses the CAEn unique sensor: Sensor 2, Null_IDF.

d. Movement rates have been adjusted to reflect mobility degradation due to man packing.

e. Note e for Unit 2 applies.

f. Unit is the equivalent of Janus system 87.

g. References:

i. Ref 3, p 358 for general data.

ii. Ref 4, p 440 for ammunition data.

iii. Ref 5, Janus database.

iv. Ref 11, for ballistic data.

v. Ref 16, for British functional data.

vi. Refs 6 and 9 for ballistic data.

44. **Unit 31. Red 120 mm mortar**.

a. The 2B115 ANI mortar modelled.

b. Unit fires the OF-843B HE ammunition, which is similar to M62P1 HE; the M64P1 smoke and M84 illuminating rounds.

c. Uses the CAEn unique sensor, Sensor 2, Null_IDF.

d. Notes c, d and e for Unit 3 apply except that unit is NOT mounted in an M113 APC but is towed by a GAZ66 truck.

e. Unit is the equivalent of Janus system 86.

f. References:

i. Ref 3, p 361 for general data.

ii. Ref 4, pp 472-474 for ammunition data.

iii. Ref 5, Janus database.

iv. Ref 11, for ballistic data.

v. Ref 16, British functional data.

vi. Refs 6 and 9 for ballistic data.

45. **Unit 32. Red 2S1 Howitzer**.

a. The unit modelled is the self-propelled 122 mm howitzer.

b. Unit fires the OF 462 HE, the D-462 smoke and S-463 illuminating rounds. Four illuminating rounds are carried. ICM rounds are not available.

c. Unit uses the CAEn unique sensor: Sensor 2, Null_IDF.

d. Notes d and e for Unit 4 apply.

e. Unit is the equivalent of Janus system 100.

f. References:
   i. Ref 1, pp 598-599 for general vehicle data.
   ii. Ref 4, pp 265-270 for ammunition data.
   iii. Ref 5, Janus database
   iv. Refs 6, 9 and 11, for ballistic data.
   v. Ref 16, for British functional data.

46. **Unit 33. Red 2S3 Howitzer.**

a. Unit is the self-propelled 152 mm howitzer.

b. Unit fires OF 540 HE and D-540 Smoke rounds, but no ICM ammunition. Data for an illuminating round could not be found. Unit can also fire 3D23 DPICM round but none are included in this database.

c. Uses the CAEn unique sensor: Sensor 2, Null_IDF.

d. Notes d and e for Unit 4 apply.

e. Unit is the equivalent of Janus system 99.

f. References:
   i. Ref 1, pp 596-598 for general vehicle data.
   ii. Ref 4, for ammunition data, pp 281-287.
   iii. Ref 5, Janus database.
   iv. Refs 6, 9 and 11 for ballistic data.

v. Ref 16, British functional data.

47. **Unit 34. Red 2S9 mortar system.**

a. The 2A51 breech loading mortar mounted on the BMD chassis is modelled. The mortar has a direct fire capacity, which has not been modelled.

b. Unit fires OF-843 HE - FRAG, HE-RAP and AP ammunition. It is assumed that it can fire the M64P1 smoke round manufactured in Yugoslavia. Available references indicate that no illuminating rounds are available. No HEAT AP rounds have been included at this time.

c. Unit uses the CAEn unique sensor: Sensor 2, Null_IDF.

d. Notes d and e for Unit 4 apply.

e. Unit is the equivalent of Janus system 96.

f. References:
   i. Ref 1, p 603 for general vehicle and weapon data.
   ii. Ref 1, p 691 for HE and HE-RAP ammunition data.
   iii. Ref 4, p 463 and 473 for ammunition data.
   iv. Ref 5, Janus database.
   v. Ref 11, pp 364 and 368 for ballistic data.
   vi. Ref 16, British CAEn functional data.
   vii. Refs 6 and 9 for ballistic data.

48. **Unit 35. Red 2S23 mortar system.**

a. The 2A51 breech loading mortar mounted on the BTR80 chassis is modelled. The mortar has a direct fire capability, which has not been modelled.

b. The unit fires of OF-49 HE-FRAG and OF-50 HE-RAP rounds. References 1 and 4 indicate that smoke and illuminating sounds can be fired but there is no information concerning which smoke and illuminating rounds are used. Until more definitive

information is available smoke and illuminating rounds are not included for this unit. The unit also fires a HEAT round in the direct fire mode but this capability has not been included. Thirty rounds of ammunition are carried.

c. Unit uses the CAEn unique sensor: Sensor 2, Null_IDF.

d. Notes d and e for Unit 4 apply.

e. Unit is the equivalent of Janus system 94.

f. References:

i. Ref 1, pp 634-635 for general and weapon data.
ii. Ref 1, p 691 for other ammunition data.
iii. Ref 5, Janus database.
iv. Ref 11, p 354 and 358 for ballistic data.
v. Ref 16, British CAEn functional data.
vi. Refs 6 and 9 for ballistic data.

49. **Unit 36. Red commander**.

a. This is a generic unit, which represents any level of commander from section/detachment commander to company/battalion commander. Unit carries 4 hand grenades and 4 smoke grenades.

b. Unit is armed with a 5.45 mm AK74 rifle and is capable of throwing any type of grenade. Rifle is loaded with a 30-round magazine at simulation start.

c. Unit is wearing standard Soviet style clothing, webbing and helmet as per operations in a summer temperate climate.

d. Notes b, c, d and f for Unit 8 apply.

e. Unit is the equivalent of Janus system 325.

f. References:

i. Ref 3, pp 133-134 for weapon data.

ii. Ref 4, p 4 for ammunition data.

iii. Ref 5, Janus database.

iv. Ref 16, British CAEn functional data.

50. **Unit 37. Red rifleman**

a. Armed the same as Unit 36 but carries five HE hand grenades.

b. Has only one sensor: Sensor 1, Eyeball.

c. Notes b and c for Unit 36 apply, except that the unit is not equipped with Sensor 3, X7 binoculars.

d. Unit is the equivalent of Janus system 338.

e. References: same as for Unit 36.

51. **Unit 38. Red RPK 74 Gunner**

a. Unit is armed with a 5.45 mm RPK Light Machine Gun that is loaded with a 40 round magazine. An additional 960 rounds are carried by the unit. Unit is also armed with two HE grenades.

b. Unit has only one sensor: Sensor 1, Eyeball.

c. Notes b and c for Unit 37 apply.

d. Unit is the equivalent of Janus system 311.

e. References:

i. Ref 3, p 247.

ii. Ref 4, p 4 for ammunition data.

iii. Ref 12, p 39 for general weapon data.

iv. Ref 5, Janus database.
v. Ref 16, British CAEn functional data.
vi. Ref 28 for ballistic data.

52. **Unit 39. Red Grenadier.**

a. Red rifleman with a 40 mm GP-25 Grenade Launcher attached to his 5.45 AK74 Rifle.

b. Unit is armed with a 5.45 AK74 rifle with a 40 mm GP-25 grenade launcher attached to the rifle. Because of the combat function and ammunition load of this unit, it was decided not to include hand thrown grenades. Weapon fires the VOG-25 fragmentation grenade. The unit carries 24 x 40 mm HE grenades. No data could be located concerning whether additional rounds are distributed among other rifle section members. Weapon can also fire the VOG-25P air burst grenade but this has not been included in the database.

c. Unit has only one sensor: Sensor 1, Eyeball.

d. Notes b and c for Unit 37 apply.

e. Unit is the equivalent of Janus system 64.

f. References:
i. Ref 3, p 203 for general weapon data.
ii. Ref 4, p 498 and Ref 11, p 249 for ballistic data.
iii. Ref 5, Janus database.
iv. Ref 16, British functional data.

53. **Unit 40. Red RPG 16 Gunner.**

a. Red infantryman specially trained to fire the RPG16 anti-armour weapon.

b. Red infantryman armed with a 5.45 mm AK74 rifle and an RPG-16 anti-armour weapon, SRAAW(M). The unit is capable of throwing all types of grenades. Unit

carries 6 RPG16 rounds and 4 smoke grenades.

c. Unit has only one sensor: Sensor 1, Eyeball.

d. Notes b and c for Unit 37 apply.

e. Unit is the equivalent of Janus system 314.

f. References:
   i. Ref 3, p 305 for general RPG16 data.
   ii. Ref 5, Janus database.
   iii. Ref 12, p 66 for ammunition data.
   iv. Ref 16, British CAEn functional data.

54. **Unit 41. Red Rifleman with RPG 18 anti-armour weapon.**

a. Unit is armed with a 5.45 AK74 rifle and three RPG 18 anti-armour weapons, SRAAW(L). Unit is also capable of throwing any type of grenade but is only armed with four smoke grenades.

b. Unit has only one sensor: Sensor 1, Eyeball.

c. Notes b and c for Unit 37 apply.

d. Unit is the equivalent of Janus system 318.

e. References:
   i. Ref 12, p 67 for general RPG18 data.
   ii. Ref 3, pp 305-306 for ammunition data.
   iii. Ref 5, Janus database.
   iv. Ref 16, British CAEn functional data.

55. **Unit 42. Red PKM Gunner.**

a. An infantryman armed with a 7.62 mm PKM general-purpose machine gun.

b. Unit is armed with a 7.62 mm PKM general-purpose machine gun with a 220-round belt of ammunition loaded. It is assumed the unit carries an additional three belts of ammunition. Unit is capable of throwing grenades of all types but it has been assumed that only two smoke grenades are carried.

c. Unit has only one sensor: Sensor 1, Eyeball.

d. Notes b and c for Unit 37 apply.

e. Unit is the equivalent of Janus system 336.

f. References:
   i. Ref 12, p 12 for general weapon data.
   ii. Ref 3, pp 248-249 for general weapon data.
   iii. Ref 5, Janus database.
   iv. Ref 16, British CAEn functional data for ballistic data.
   v. Ref 28 for ballistic data.

56. **Unit 43. Red sniper.**

a. Red infantryman specially trained as a sniper.

b. Unit armed with a 7.62 mm DRAGUNOV(SVP) sniper rifle. Unit is also capable of throwing all types of grenades but usually only carries two smoke grenades. It has been assumed that the unit carries a total of 110 x 7.62 mm rounds.

c. Unit has only one sensor: Sensor 1, Eyeball.

d. Weapon has Sensor 21, X4 telescope.

e. Notes b and c for Unit 37 apply but it has also been assumed that the maximum target acquisition time is the same as the aim time maximum of 40 seconds to reflect a more deliberate and careful target acquisition and engagement process.

f. Unit is the equivalent of Janus system 317.

g. References:

i. Ref 3, pp 130-131 and Ref 12, p 18 for general weapon data.

ii. Ref 4, p 28 for ammunition data

iii. Ref 5, Janus database.

iv. Ref 16, British CAEn functional data.

57. **Unit 44. Red HMG Gunner.**

a. Red infantryman trained as an HMG Gunner.

b. Red Infantryman armed with a 5.45 mm AK74 rifle and a 12.7 NSV heavy machine gun. Gunner is part of a two-man team sharing the carriage of the gun and ammunition. Gunner is assumed to carry five 30 round 5.45 mm magazines. The gunner has not been given the capability to throw grenades. The unit carries 1100 rounds of 12.7 mm ammunition.

c. Unit has only one sensor: Sensor 1, Eyeball.

d. Notes b and c for Unit 36 apply except that speeds have been reduced to reflect the weight of the gun and the ammunition.

e. Unit is the equivalent of Janus system 322.

f. References:

i. Ref 3, pp 250-251 for general weapon data.

ii. Ref 4, p 67 for ammunition data.

iii. Ref 5, Janus database.

iv. Ref 16, British CAEn functional data.

58. **Unit 45. Red AGS-17 Gunner.**

a. Red infantryman specially trained as an AGS-17 grenade launcher gunner.

b. Unit is armed with a 5.45 mm AK74 rifle and an AGS-17 30 mm automatic grenade launcher. Unit carries 150 5.45 mm rifle rounds and four drums of ammunition each

carrying 30 grenades. Gunner is part of a two-man team. The gunner has not been given the capability to throw hand-launched grenades. No data on the VOP-17m grenade could be located. The gunner is assumed to carry all the 30 mm ammunition - four 30 round drums.

c. The unit has only one sensor: Sensor 1, Eyeball.

d. Notes b and c for Unit 36 apply except that speeds have been reduced to reflect the weight of the ammunition and the weapon.

e. Unit is the equivalent of Janus system 335.

f. References:

i. Ref 3, pp 201-202 and Ref 12, p 62 for general weapon data.

ii. Ref 5, Janus database.

iii. Ref 11, p 214 for ballistic data.

iv. Ref 16, British CAEn functional data.

59. **Unit 46. Red AT-4 Gunner.**

a. Red Infantryman specially trained to fire the AT-4 anti-tank guided missile system (ATGM), also known as the 9K111 FAGOT.

b. Unit is armed with a 5.45 mm AK74 rifle and an AT-4 ATGM launcher. The gunner is part of a two-man team each carrying part of the launcher system and ammunition. AT- 4 launcher is ground mount version. All missiles are assumed to be carried by the gunner in this database. The unit can also fire the RM111M missile with a range of 2500m. Gunner carries three RM111-2 missiles and two RM111M missiles. The unit is not capable of throwing grenades in this version of the database.

c. Unit has one sensor: Sensor 1, Eyeball.

d. Weapon uses Sensor 36, X10 AT4/5 sight.

e. Notes b and c for Unit 36 apply except that speeds have been reduced to reflect the

weight of the launcher and ammunition.

f. Unit is the equivalent of Janus system 310.

g. References:

i. Ref 3, pp 309-310 and Ref 12, p 130 for general weapon data.

ii. Ref 3, pp 309-310 and Ref 2, pp 61-62 for ammo and ballistic data.

iii. Ref 5, Janus database.

iv. Ref 16, British CAEn functional data.

60. **Unit 47. Red AT-5 Gunner.**

a. Red infantryman specially trained to fire the AT-5 ATGM system which is also known as the SPANDREL or the 9K 113 KONKURS.

b. Notes a and c for Unit 46 apply with the following exceptions: Fires the 9K113 KONKURS missile and 3 rounds are carried by the gunner in this database.

c. Unit has one sensor: Sensor 1, Eyeball.

d. Weapon uses Sensor 36, X10 AT4/5 sight.

e. Unit is the equivalent of Janus system 334.

f. References:

i. Ref 3, pp 310-311 and Ref 12, p 134 for general weapon data.

ii. Ref 3, pp 310-311 and Ref 2, pp 60-61 for ammo and ballistic data.

iii. Ref 5, Janus database.

iv. Ref 16, British functional data

61. **Unit 48. Red AT-7 Gunner**.

a. A Red infantryman specially trained to fire the AT-7 ATGM system, which is also known as the SAXHORN or 9K115 METIS.

b. Notes a and c for Unit 46 apply with the following exceptions. The gunner is armed with the AT-7 system instead. The AT-7 fires the RM115 METIS missile and three missiles are carried by the gunner in this database.

c. The unit has one sensor: Sensor 1, Eyeball;

d. Weapon uses Sensor 37, X6 AT7 sight.

e. Unit is the equivalent of Janus system 332.

f. References:
   i. Ref 3, pp 311-312 for general weapon data.
   ii. Ref 3, pp 311-312 for ammunition and ballistic data.
   iii. Ref 5, Janus database.
   iv. Ref 16, British CAEn functional data.

62. **Unit 49. Red AT-14 Gunner.**

a. A Red infantryman specially trained to fire the AT-14 ATGM system, which is also known as the KORONET.

b. Notes a and c for Unit 46 apply with the following exceptions. The gunner is armed with the AT-14 ATGM system instead. The AT-14 fires a derivative of the 9K115 METIS missile and three missiles are carried by the gunner in this database.

c. The unit has one sensor: Sensor 1, Eyeball.

d. Weapon uses Sensor 38, X10 AT14 sight.

e. Unit is the equivalent of Janus system 308.

f. References:
   i. Ref 3, pp 312-313 for general weapon and ballistic data.
   ii. Ref 5, Janus database.
   iii. Ref 16, British CAEn functional data.

63. **Unit 50. Red Recce detachment member.**

a. This is a generic type of soldier who can represent infantry or armoured crewman specially trained for recce tasks.

b. Unit is armed with a 5.45 mm AK74 rifle with 150 rounds of ammunition. Unit is capable of throwing all types of hand grenades but it has been assumed that only smoke grenades are carried.

c. Unit has two sensors:
   i. Sensor 1, Eyeball
   ii. Sensor 3, X7 binoculars.

d. Notes b, d and f for Unit 8 apply as does Note b for Unit 36.

e. Unit is the equivalent of Janus systems 327 and 328.

f. References:
   i. Ref 3, pp 133-134 and Ref 12, p 23 for general weapon data.
   ii. Ref 4, p 4 for ammunition data.
   iii. Ref 5, Janus database.
   iv. Ref 16, British CAEn functional data.

64. **Unit 51. Red Artillery/Mortar, command observation post.**

a. This represents an artillery or infantry command observation post, which is capable of calling for and adjusting indirect fire.

b. Unit is armed with a 5.45 mm AK74 rifle with 150 rounds of ammunition. Unit is capable of throwing all types of hand grenades and carries four HE and four smoke grenades.

c. Unit has two sensors:
   i. Sensor 1, Eyeball.
   ii. Sensor 3, X7 binoculars.

d. Notes b, d and f for Unit 8 apply as does note b for Unit 36.

e. Unit is the equivalent of Janus system 319 and 320.

f. References: same as for Unit 50.

65. **Unit 52. Red T72-ERA.**

a. Red T-72 tank with Explosive Reactive Armour. The Russian T-72 is modelled.

b. Unit is armed with a 125 mm 2A46 smooth bore main tank gun and a 7.62 mm coax machine gun. The main gun fires the 3BM9 APFSDS and the 3BK18 HEAT armour piercing rounds. It also fires the 30F26 HE FRAGMENTATION round. Two through the barrel missiles can be fired - the AT-8 and AT-11 missiles. For this database only the AT-11 missile has been included. The AT-11 is also known as the 9M119 REFLEKS. According to Ref 1, a total of 45 main gun rounds are carried. Ammunition load based on Ref 1 is 12 APFSDS, 6 HEAT, 21 HE FRAG and 6 AT-11 rounds. 2000 rounds of 7.62 mm ammunition are carried.

c. The unit has the following sensors:
   i. Sensor 1, Eyeball.
   ii. Sensor 3, X7 binoculars.
   iii. Sensor 4, vision blocks.
   iv. Sensor 33, X5.1 T72/80 optical sight.

d. The tank main weapon uses the following sensors:
   i. Sensor 34, X12 optical sight.
   ii. Sensor 35, T72/80 TI sight.

e. Notes b, d and f for Unit 8 apply.

f. Unit is the equivalent of Janus system 387.

g. References:
   i. Ref 1, pp 87-89 for general vehicle data.

ii. Ref 1, pp 79-83 for weapon data and pp 87-89 for ammunition load.
iii. Ref 2, p 588 for sensor data.
iv. Ref 4, pp 210-217 for ammunition data.
v. Ref 5, Janus database.
vi. Ref 11, p 209 for ballistic data.
vii. Ref 16, British CAEn functional data.

66. **Unit 53. Red T-72.**

a. A Red T72 Tank without ERA has been modelled. The Russian T72B1 is modelled.

b. All notes for Unit 52 apply except that this T-72 does not have Sensor 35, T72/80 TI sight. It does not fire the AT-11 missile. Ammunition load is assumed to be 18 APFSDS, 6 HEAT and 21 HE-FRAG rounds.

c. Unit is the equivalent of Janus system 391.

67. **Unit 54. Red T-80U.**

a. The Russian T-80U Tank has been modelled.

b. All notes for Unit 52 apply.

c. Unit carries 1250 7.62 mm coax rounds.

d. Unit is the equivalent of Janus system 385.

e. References.
i. Ref 1, pp 82-83 for general vehicle data.
ii. Ref 1, p 83 for ammunition loads.
iii. Ref 2, p 588 for sensor data.
iv. Ref 4, pp 210-217 for ammunition data.
v. Ref 5, Janus database.
vi. Ref 11, p 209 for ballistic data.
vii. Ref 16, British CAEn functional data.

68. **Unit 55. Red BTR70.**

a. The Russian BTR70 eight-wheeled lightly armoured APC has been modelled. The vehicle can carry an infantry section.

b. Unit is armed with a turret-mounted 14.5 mm KPVT heavy machine gun and a 7.62 mm PKT coax machine gun. 500 rounds of 14.5 mm and 2000 rounds of 7.62 mm ammunition are carried. No smoke dischargers have been modelled nor has the manifold smoke capability.

c. Unit has three sensors:
   i. Sensor 1, Eyeball.
   ii. Sensor 3, X7 binoculars.
   iii. Sensor 4, vision blocks.

d. Weapon uses Sensor 23, X 2.6 sight.

e. Notes b, d and f for Unit 8 apply.

f. Unit is the equivalent of Janus system 368.

g. References:
   i. Ref 1, pp 458-459 for general vehicle data.
   ii. Ref 3, pp 251-252 for weapon data.
   iii. Ref 4, p 64 for ammunition data.
   iv. Ref 5, Janus database.
   v. Ref 14, for sensor data and Ref 2, p 550.
   vi. Ref 16, British CAEn functional data.

69. **Unit 56. Red BTR 80.**

a. The Russian BTR 80 eight wheeled, lightly armoured vehicle has been modelled. The vehicle can carry an infantry section.

b. Notes a, b and d for Unit 55 apply.

c. Dimensions and speeds in Unit Data File are slightly different from those for Unit 55.

d. Unit is the equivalent of Janus system 367.

e. References:

i. Ref 1, pp 456-458 for general vehicle data.
ii. Ref 3, pp 251-252 for weapon data.
iii. Ref 4, p 64 for ammunition data.
iv. Ref 5, Janus database.
v. Ref 14 and Ref 2, p 550, for sensor data.
vi. Ref 16, British CAEn functional data.

70. **Unit 57. Red BRDM2.**

a. The Russian four-wheeled lightly armoured recce vehicle has been modelled.

b. Unit is armed the same as Unit 55.

c. Notes a, b, c and d for System 55 apply.

d. Unit is the equivalent of Janus system 375.

e. References:

i. Ref 1, pp 217-219 for general vehicle data.
ii. Ref 3, pp 251-252 for weapon data.
iii. Ref 4, p 64 for ammunition data.
iv. Ref 5, Janus database.
v. Ref 14 and Ref 2, p 550, for sensor data.
vi. Ref 16, British CAEn functional data.

71. **Unit 58. Red BMP1.**

a. The Russian BMP1 tracked infantry section vehicle has been modelled.

b. Unit is armed with the 73 mm 2A28 low-pressure cannon, which fires the PG15VN

HEAT round. Forty rounds are carried. It is also armed with a launch system for the AT3 SAGGER missile and five AT3 missiles are carried. There is also a 7.62 mm PKT coax machine gun.

c. Unit uses sensors:
   i. Sensor 1, Eyeball.
   ii. Sensor 3, X7 binoculars.
   iii. Sensor 4, Vision blocks.
   iv. Sensor 25 X6 optical sight.

d. Weapons use:
   i. Sensor 25, X6 optical sight.
   ii. Sensor 26, X6.7II sight.

e. Notes b, d and f for Unit 8 apply.

f. Unit is the equivalent of Janus system 381.

g. References:
   i. Ref 1, pp 319-320 for general vehicle data.
   ii. Ref 1, pp 319-323 for weapon data.
   iii. Ref 3, pp 308-309 and Ref 2 pp 62-63 for ammunition data.
   iv. Ref 4, pp 134-135 for ammunition data.
   v. Ref 5, Janus database.
   vi. Ref 7, pp 5-18 for general vehicle data.
   vii. Ref 11, p 219 for ballistic data.
   viii. Ref 16, British CAEn functional data.

72. **Unit 59. Red BMP2.**

a. The Russian BMP2 tracked infantry section vehicle has been modelled.

b. The unit is armed with the 30 mm 2A42 cannon, which fires AP-T and HE-T ammunition. 160 AP-T and 340 HE-T rounds are carried. It is also armed with a launch system for the AT-5 SPANDREL missile. A 7.62 mm PKT coax machine gun is also included.

c. The unit has the following sensors:
   i. Sensor 1, Eyeball.
   ii. Sensor 3, X7 binoculars.
   iii. Sensor 4, Vision blocks.
   iv. Sensor 27, X4 optical sight.

d. The weapon has the following:
   i. Sensor 28, X6 optical sight
   ii. Sensor 29, BMP2 TI sight.

e. Notes b, d and f for Unit 8 apply.

f. Unit is the equivalent of Janus system 380.

g. References:
   i. Ref 1, pp 316-318 for general vehicle and weapon data.
   ii. Ref 3, pp 310-311 for ammunition and ballistic data.
   iii. Ref 4, pp 90-91 for ammunition data.
   iv. Ref 12, p 134 for ammunition and weapon data.
   v. Ref 5, Janus database.
   vi. Ref 16, British CAEn functional data.

73. **Unit 60. Red BMP2 with ERA.**

a. Notes a, b, c and e for Unit 59 apply.

b. The armour protection, dimensions and speeds are different from those of Unit 59. These differences are reflected in the Unit Data File for this unit and in various SSKP target files.

c. Unit is the equivalent of Janus system 283.

74. **Unit 61. Red BMP3.**

a. The Russian BMP3 APC has been modelled. The vehicle has several weapons systems and is capable of carrying an infantry section.

b. The unit is armed with a 100 mm gun, which fires the 3UOF17 HE FRAGMENTATION round and the AT-10 STABBER through the barrel missile. There is also a 30 mm 2A70 cannon, which is different from the 30 mm cannon on the BMP2. This weapon fires APDS-T, HE-I and HE-T ammunition. 305 HE-I and HE-T and 195 AP-T rounds are carried. APDS rounds can also be fired but have not been included in this database. There are also three 7.62 mm machineguns on the vehicle located as follows, one coax in the turret and one on either side of the front of the vehicle hull. To simplify modelling the three machine guns, only the coax gun has been included but it has been given the ammunition for all three guns. 40 rounds of 3UOF17 HE FRAG are carried, as well as 8 AT-10 missiles and 6000 7.62 mm rounds. Note that the commander's and gunner's air defence sights have not been included.

c. The unit uses the following sensors:
   i. Sensor 1, Eyeball.
   ii. Sensor 3, X7 binoculars.
   iii. Sensor 4, Vision blocks.
   iv. Sensor 30, X5 optical sight.

d. The weapon uses the following sensors:
   i. Sensor 31, X8 optical sight.
   ii. Sensor 32, BMP3 TI sight.

e. Notes b, d and f for Unit 8 apply.

f. Unit is the equivalent of Janus system 379.

g. References:

i. Ref 1, pp 312-315 for general vehicle and weapon data.

ii. Ref 2, p 58 for weapon data and Ref 22, p 301 and p 303.

iii. Ref 3, for ammunition data and Ref 22, p 301 and p 303.

iv. Ref 4, pp 90-91 and p170 for ammunition and ballistic data.

v. Ref 13, pp 305 for AT-10 data.

vi. Ref 14, for sensor data and Ref 22, pp 302-303.

vii. Ref 5, Janus database.

viii. Ref 16, British CAEn functional data.

ix. Ref 23, BMP3 Russian Manufacturer's Sales Brochures

75. **Unit 62. Blue CLAYMORE.**

a. An anti-personnel system, which can be command or trip-wire detonated. It has been modelled as command detonated in this database. It uses Sensor 1, Eyeball. See Ref 3 for general and munitions data, as well as applicable weapons and ammunition data files for specific information and Reference 24 for technical and performance data. In this database only Blue forces have been allocated these types of munitions. See Reference 24 for technical data on claymore.

76. **Units 63 and 64.**

a. A ground emplaced flare illumination device has been modelled with the same characteristics and technical specifications used for both the Blue and Red flares. Although ground emplaced flares are normally activated by trip wire for ease and simplicity of modelling the flare is activated by command detonation in the same manner as Unit 62, the claymore. Unit 63 is the Blue flare and Unit 64 is the Red flare. Both flares use a unique sensor, Sensor 39, minor sensor. See Ref 3 for general and illumination data as well as applicable weapons and ammunition data files for specific information.

CHAPTER III - NOTES TO CAEn DATA FILES

77. The following notes document the assumptions, add additional explanations and describe decisions made with regard to the selection of data values for various parameters. Note that data for several parameters were not available from Canadian sources. This has necessitated the use of British functional data or the determination of a value based on military and scientific judgement.

NOTES TO UNIT DATA FILES

UNIT INDEX FILE

78. The Unit Index File is used to list by name the units defined in the database at any given time. It also identifies each unit data file that the CAEn software accesses. Annex A lists all CAEn Blue and Red units available in the database.

79. The version 8.1 format for a unit index file is illustrated in the example below with the numerical columns representing the Sensor_View_Shape_Type data.

```
Unit Index File
number_of_types     6                    Sensor_View_Shape_Type
1  B_RIFMN        f_infantry blue_side   1  6  9 10 24  7 cansunits:B_RIFMN.dat
TRUE  FALSE
2  R_RIFMN        f_infantry red_side    1  6  9 10 24  7 cansunits:R_RIFMN.dat
TRUE  FALSE
3  B_LEO_C1       f_tank     blue_side   2  2  2  2  2  2 cansunits:B_LEO_C1.dat
TRUE  FALSE
4  R_T72          f_tank     red_side    3  2  2  2  2  2 cansunits:R_T72.dat
TRUE  FALSE
5  B_M113_A3      f_apc      blue_side   4  7 17 17 17 17 cansunits:B_M113_A3.dat
TRUE  FALSE
6  R_BMP2         f_apc      red_side    5 17 17 17 17 17 cansunits:R_BMP2.dat
TRUE  FALSE
7  B_AH_LW_COBRA f_heli      blue_side 23 20 20 20 20 20 cansunits:B_AH_LW_COBRA.dat
TRUE  FALSE
```

Figure 1: Unit Index File

80. Every unit has a Sensor_View_Shape_Type index which is referenced by an integer between 1 and 23 (first column of figures of the Sensor_View_Shape_Type). This parameter is used by the simulation when a player activates the Draw Sensor View Shape function during the deployment phase and scenario play. It is related to the Unit_Shape_Index that tells the sensor view function what shape to draw to represent units, which are visible in the sensor view being drawn. The Unit_Shape_Data_Files contain the information that tells the Graphical User Interface (GUI) how to draw the shape. All infantry units, including indirect fire units, whether they are Blue or Red, take the form of an individual soldier and are referenced by Sensor_View_Shape_Type 1. Tanks and APCs respectively take the form of a three dimensional tank or APC, but the shape is slightly different from one side to the other. This explains why a Blue tank and a Blue APC are referenced differently than a Red tank and a Red APC.

81. Regardless of which type of tank is included in a scenario, when the Sensor_View is activated, all Blue tanks use the British CHALLENGER tank. Thus if a scenario contains both Blue Leopard and M1A1 ABRAMs type tanks, both will be drawn using shape type 2 based on the CHALLENGER tank. Similarly, all Red tanks are based on a T-80 tank, all Blue APCs on a British Warrior IFV and all Red APCs on a BMP, IFV. Sensor view shapes types 1 to 5 and 23 are currently the only ones used by the CAEn military database although there is a much larger set of shapes used by the civilian database.

82. The remaining five number columns of the Sensor_View_Shape_Type correspond to the posture shape of the icon to be drawn when the player selects "Draw Sensor View" from the Unit Data menu during interactive scenario play. From left to right the numbers refer to COVERED, HEAD UP, EYES UP, CROUCHING and STANDING posture states. Each number refers to an icon that is embedded in the simulation code. Thus, if a Red rifleman in a STANDING posture is visible on the screen, the simulation will select view shape type 1 and icon 7 to be drawn in the sensor view box when a player activates the Draw Sensor View function. Similarly, if a Red rifleman in a CROUCHING posture is visible on the screen, the simulation will select this time view shape 1 and icon 24 to be drawn in the sensor view box.

83. There are two additional columns in the Unit Index File, which are not visible in the screen when the index is displayed. Pan the slide bar at the bottom of the screen as far to the right as possible and the two columns will appear. The first column sets whether the unit icon is to appear in the screen graphics. A TRUE response is set to make the icon appear. Generally, all units in the database are set to appear in the simulation graphics. The second column is the TROT parameter,

which is only used in the CAEn civilian database. Since this is not used by the military database, a FALSE response will be set for all units listed in the unit index of the ORD database.

NOTES TO INFANTRY UNITS

84. The following are explanatory notes about parameters contained in infantry unit data files. Please refer to Annex B for an example.

85. **Unit_Identification.** Units are identified using the nomenclature of the unit as it is contained in column 2 of Figure 1. This nomenclature can be written in full or abbreviated.

86. **Temperature**. Unless otherwise noted, all RED and BLUE infantry units have a common temperature of 16.3 degrees Celsius.

87. **Entity_speed_lookup.** This is a new parameter in version 5.1. It appears that in all infantry unit data files a common text entry "milunits: entity_speed_lookup_null.dat" is inserted after the header. No explanation of what this parameter does is available and it appears to apply only to the civilian database.

88. **Inf_Speed_Type**. Values were determined by timing and measuring different speed states of a small sample of soldiers of different size, armed with rifles and light automatic or anti-armour weapons and carrying different loads. The same procedure was then used for soldiers armed with crew-served weapons such as general-purpose machine guns, light mortars and medium anti-armour weapons. An average speed was then calculated for each grouping and the values were then entered in the speed category columns of the infantry_speed parameter. All speeds are in meters per second. Figure 2 contains an example of this parameter for daylight conditions. For units carrying crew-served weapons and heavier loads, the speeds should be reduced by 0.2

inf_speed_type	stopped	slow	walk	run
infantry_speed	0.0	0.8	1.9	3.0

Figure 2: Infantry Day Speeds

89. ORD also developed speeds for use in night scenarios. Figure 3 illustrates these speeds for infantry units. As for day speeds, night speeds are reduced by a factor of 0.2 for units armed with

crew-served weapons and carrying heavier or bulkier loads (See Ref 35 which explains the methodology used to develop night speeds).

inf_speed_type	stopped	slow	walk	run
infantry_speed	0.0	0.7	1.5	1.7

Figure 3: Infantry Night Speeds

90. **Gradient_deg.** This parameter contains eight graduations of gradient from 0 to 37 degrees and two speed types; "x_country_speed" and "road_speed." Each gradient column contains a speed multiplier for each infantry speed type. No Canadian data was available, so modified British values based on best scientific and military judgement in relation to the Petawawa terrain have been used. Figure 4 displays the gradient speed factors for infantry units.

gradient_deg	0	2	4	6	10	20	30	37
x_country_speed	1.0	0.95	0.90	0.85	0.70	0.50	0.40	0.35
road_speed	1.0	0.98	0.93	0.88	0.75	0.55	0.45	0.40

Figure 4: Gradient Degree

91. **Terrain_Type.** This parameter in previous versions of CAEn contained three terrain types: "general, road and water." In CAEn 8.1 unit data files, the "general and road" data fields of the terrain type parameter are now incorporated into the values for the "x_country_speed" and "road_speed" parameters of the "gradient degree" data parameter. The only terrain type in this parameter is "water" (see Annex B). If a 0.0 value is entered the unit will stop moving when it encounters the water. See Ref 31.

92. **Terrain_Speed_Culture_Type.** The terrain speed section of the data file defines the maximum speed a unit can attain when moving through different terrain cultures types. CAEn versions 5.1 and 8.1 support many more urban, simple and complex culture types than in previous versions of CAEn. As stated in Ref 31, if these fields do not contain values in the applicable unit data files but the culture types were used in terrain data files, strange results will be noticed. For example, if the terrain contains 11 urban, 9 vegetation and 15 complex culture types, speed

multiplier values must be inserted in all 11 urban, 9 vegetation and 15 complex culture types of the scenario unit data files for all units. Zero values can be used in undefined culture types. Zero values inserted in defined urban terrain culture types will prevent infantry from entering buildings. Consequently values are usually inserted in all urban terrain types to permit infantry to enter buildings of the types defined. See also paragraph 146 in the notes to vehicle units. No Canadian data was available so modified British values, based on best scientific and military judgement in relation to the Petawawa terrain, have been used. Figure 5 displays terrain speed factors for infantry units.

terrain_type	urban_1	urban_2	urban_3	urban_4	urban_5	urban_6
terrain_speed	0.75	0.75	0.75	0.75	0.275	0.75
terrain_type	veg_1	veg_2	veg_3	veg_4	veg_5	veg_6
terrain_speed	0.90	0.70	0.77	0.77	0.60	0.60
terrain_type	cmplx_1	cmplx_2	cmplx_3	cmplx_4	cmplx_5	cmplx_6
terrain_speed	0.70	0.95	0.75	0.95	0.95	0.95

Figure 5: Terrain Type Speed Multipliers

93. **Posture_States and Posture_speeds.** There are five posture states for infantry units in CAEn. Figure 6 illustrates the five posture states as defined by the CAEn software version 8. 1. It also illustrates the posture speeds, which correspond, to the maximum speed a unit can attain in any selected posture state. A speed multiplier factor is defined for each posture state, which alters the maximum speed, usually by reducing the speed defined in the infantry_speed_type section. The speed is altered because it may not be possible to attain the maximum speed defined because of the posture of the unit. Note that if zeros are inserted for all five posture states, the unit will never move, even though it may have a defined route.

posture_state	covered	head-up	crawling	crouching	standing
posture_speed	0.00	0.00	0.20	0.40	1.00

Figure 6: Posture Speeds Multipliers

94. The titles of each posture state as listed above are embedded in the simulation code. In order to change the titles the code must be changed. Note that the posture states start with the least exposed state in the left hand column, graduating through a range of increasing intermediate states and ending with the most exposed state in the right hand column. For example, a unit in a

COVERED state is completely hidden or not visible and hence no line of sight to or from it is possible. For ORD purposes an infantry unit in HEAD UP posture is considered to be a soldier in a firing position behind the parapet of his trench. An infantry unit who is crawling or kneeling is partially exposed in varying degrees while a standing unit is completely or fully exposed. Note that STANDING is usually associated with a completely exposed infantryman while FULLY EXPOSED is usually associated with completely exposed vehicle units.

95. For each of the five posture/cover states there are four associated dimension parameters being unit height, unit width, unit length and sensor height. Figure 7 displays standardized dimensions for a single average size RED or BLUE infantryman. Determination of the various posture dimensions was derived from actual measurements of a soldier in these postures.

posture_state	covered	head-up	crawling	crouching	standing
Unit_height	0.00	0.34	0.45	1.62	1.77
Unit_width	0.00	0.47	0.93	0.51	0.51
Unit_length	0.00	0.58	1.24	0.58	0.58
Sensor_height	0.00	0.19	0.30	1.47	1.62

Figure 7: Posture States

96. **Unit Height**. This parameter is measured from the soles of the boots to the crown of the helmet for CROUCHING and FULLY EXPOSED postures. For the CRAWLING posture the measurement is from the chest flat against the ground to the crown of the helmet with the head not fully in an extended position of observation. In the HEAD UP position only a small portion of the shoulder/torso is visible. Note that the HEAD UP position represents that portion of a soldier that would be visible if the soldier were in a trench in a firing position.

97. **Unit Width**. This represents the full head on or front aspect of a unit. In the HEAD UP posture, the measurement is the distance of the widest part of the helmet; in the CRAWLING posture, the measurement is the distance from elbow to elbow with the arms of the prone body extended fully outwards. In the CROUCHING and FULLY EXPOSED posture, the soldier is assumed to be in a firing position. The measurement is again the distance from one elbow to the other with the remainder of the body being fully exposed.

98. **Unit Length**. This dimension may more accurately or clearly be defined as depth of the figure. In general the measurement is the distance between the chest and the back with an additional

amount included for clothes and webbing for HEAD UP, CROUCHING and FULLY EXPOSED postures. The CRAWLING posture presents a different aspect. In this case it has been assumed, based on best military judgement, that approximately 70% of a soldier's FULLY EXPOSED height may be visible.

99. **Sensor_Height**. This is the distance from the surface the unit is either positioned on or is looking over to the top of the eye socket of the face.

100. Posture states are scenario dependent and separate posture states and dimensions may have to be defined for each study scenario and as new units are added to the simulation. If this is required it may be more expedient and simpler for the user to create a new table of posture state titles based on study requirements, which can be referenced by players rather than changing the posture titles within the code each time a change is required. The new title table would show the player how the new posture titles correspond to the ones listed in Figure 7 that are embedded in the code. Dimension data for newly defined posture states is easily changed in each of the unit data files unit dimensions section.

101. Based on perceived study requirements ORD has chosen to define posture state titles for infantry units as follows. For example the ORD posture CRAWLING equates/corresponds to the embedded title of HEAD UP. The player during scenario play clicks on HEAD UP in the menu box to instruct the simulation to access the dimension data for CRAWLING as defined by ORD and likewise clicks on CRAWLING to access CROUCHING dimension data. This may appear a bit confusing but avoids constant changing of the code. An equivalency table may look as the example below:

TABLE I

EQUIVALENCY TABLE FOR POSTURE STATES

EMBEDDED TITLE	COVERED	EYES UP	HEAD UP	CRAWLING	FULLY EXPOSED
	▼	▼	▼	▼	▼
SCENARIO TITLE	COVERED	HEAD UP	CRAWLING	CROUCHING	FULLY EXPOSED

102. **Number_of_Sensors.** All infantry units included in the ORD master database, unless they represent a commander, FOO or Recce/ observer, have only one sensor, that being eyeballs.

Commanders, FOO and Recce may have additional sensors - usually binoculars or a night vision device. Some studies may require all or particular infantry units to have additional sensors with one of the additional sensors likely being some form of night vision goggle. If this is the case, the scenario database will have to include these. Infantry units usually have what are termed free-standing sensors, such as eyeballs or binoculars, which are sensors not connected to a weapon.

103. **Number_of_Weapons.** All infantry units, less indirect fire units, have at least two weapons: their principal weapon and a CAEn unique weapon known as HAND, as illustrated below in Figure 8. In CAEn, a hand weapon is required in order to throw a grenade.

```
Number_of_weapons        2
      Weapon_id                8      (C7 rifle)
      Ammo_id                  31     (5,56 mm bullet)
      Num_loaded_rounds        30
      Weapon_id                22     (hand)
      Ammo_id                  40     (HE grenade)
      Number_loaded_rounds      1
      Ammo_id                  42     (Smk grenade)
      Number_loaded_rounds      0
```

Figure 8: Weapons Data Block

104. **Number_of_ loaded_rounds**. For RED and BLUE rifles, the number of loaded rounds is the number contained in a single magazine. For indirect fire weapons, large calibre direct fire, or weapons without a magazine, at least one round is always loaded in the principal weapon.

105. **Number_of_unloaded_rounds**. This is the number of rounds normally carried by the man for the weapon, less the number of rounds loaded, that is to say a single round, or a fully loaded magazine or a belt of ammunition. If a weapon carries multiple types of ammunition and only one type can be loaded at a time do not indicate in the "Number of weapons" data block that the weapon has X ammos some of which are unloaded. This information appears in the "Number of ammos" data block instead, as illustrated below in Figure 9.

106. The example below that 3 of the 4 HE grenades are unloaded, as well as the four smoke grenades. See Ref 32 for a more complete explanation concerning how these parameters should be handled.

```
Number of ammos          3
      ammo_id                31
      num_unloaded_rounds    220
      ammo_id                 40    (HE grenade)
      num_unloaded_rounds     3
      ammo_id                42     (Smk grenade)
      number_unloaded_rounds  4
```

Figure 9: Ammunition Data Block

107. **Prioritization_of_Weapons_and_Ammunition.** With regard to weapons and ammunition, it has been suggested by the British that if a unit has more than one weapon or ammunition type that when the data sheet is filled out that the weapons and ammunition be listed in priority with the most frequently used weapon/ammunition combination listed first followed by the others in decreasing order of frequency or importance. The weapon/ammunition frequency of use priority should be reviewed for each scenario and be amended, if necessary, based on scenario requirements. Ref 32 states:

> " The priority of ammunition in multiple nature weapons only becomes important if a weapon has two similar munitions. When it has a smoke and an HE round the model can discriminate (1X HE az and 1X smoke az). Instances where problems could arise include the main armament on a vehicle which can fire HE and AP. In this case the order of the ammunition in the lists becomes important."

108. **Target_Type_ID.** The target_type_id defines the unit's target type for use with the SSKP file. It is an integer value that can be linked to a set of SSKP data in the kill file. For purposes of this database the following Target Type IDs have been defined and are applicable to both RED and BLUE. The target type ID definitions generally correspond to target types in the ORD Janus database.

a. Target type ID 1 — all personnel targets including indirect fire units.

b. Target type ID 2 — all tank or heavily armoured vehicles that have explosive reactive armour (ERA) or add on armour packages.

c. Target type ID 3 — all tank or heavily armoured vehicles that do NOT have explosive reactive armour (ERA) or add on armour packages.

d.	Target type ID 4	lightly armoured wheeled APCs or direct fire support vehicles.
e.	Target type ID 5	lightly armoured-wheeled APCs with add on armour packages or ERA.
f.	Target type ID 6	lightly armoured tracked APCs without ERA or add on armour packages.
g.	Target type ID 7	lightly armoured tracked APCs with ERA or add on armour packages.
h.	Target type ID 8	Infantry fighting vehicles with medium to heavy armour.
i.	Target type ID 9	Wheeled unarmoured general-purpose vehicles, e.g.: trucks.
j.	Target type ID 10	Helicopters

109. **Mine_Target_Type_ID.** Similar to the Target Type IDs defined above, this parameter is applicable to a specific set of "ids" linked to the degrees of destruction/damage values in the mines data files. Mine_target_type_ids are user definable. The mine_target_type_id defines how well protected the target is against the levels of damage caused by the mine explosion. Several mine_target_type_ids can be defined.

110. **Body_Armour_ID**. The effectiveness of body/vehicle armour with regard to bullet ammunition types is expressed in a new manner in Version 8.1. It is expressed in terms of a protection probability based on the firer in different postures to target range and ammunition type. The term body_armour_id in infantry unit files and armour_id in vehicle unit files defines the same thing, at least with respect to bullet ammunition. Any number of different body armour types can be defined ranging from armour which offers little or no protection, to armour that offers some protection, to armour which offers complete protection against various types of bullets. The data is defined in the Body_Armour_Protection Probabilities file. For each body armour a numerical body_armour_id type is defined as well as a set of protection probabilities. Infantry and vehicle units can then be assigned a specific body/vehicle armour type to satisfy scenario requirements. The specific body/armour type is defined in the appropriate infantry or vehicle unit file by inserting the number of the body/vehicle armour type selected after the body_armour_id parameter. Perfect

body/vehicle armour should be applied to all vehicles that are not to be affected by bullet ammunition such as tanks and heavily armoured APCs. In this way, bullet ammunition is prevented from causing a catastrophic kill to these types of vehicles. Body armour protection probabilities can also be defined for various types of HE warhead and NEXTGEN ammunition. But because body armour protection probability data has been difficult to locate, only two types of body/vehicle armour have been defined in the current ORD CAEn database: the first type is for no body armour and the second type is for perfect body armour capable of stopping all rounds. In terms of infantry units, body armour is used primarily to provide additional protection as if infantry were wearing protective clothing such as "flak vests" and, secondly, as a means of preventing bullets from killing heavily armoured vehicles, such as tanks that a bullet is incapable of penetrating. Figure 10 is an example of part of a Body Armour_Protection_probabilities file against a tank round.

```
Body_Armour_Protection_Probabilities
Number_of_Body_Armours      2
 Body_Armour_ID      1
     Number_of_Ammos      2
          Ammo_id      1
          Number_of_Ranges      10
               Range    Cov      EU       HU       Crl      FE
               0         0       0        0         0       0
               100       0       0        0         0       0
               200       0       0        0         0       0
               300       0       0        0         0       0
               400       0       0        0         0       0
               500       0       0        0         0       0
               600       0       0        0         0       0
               700       0       0        0         0       0
               800       0       0        0         0       0
               900       0       0        0         0       0
Body_Armour_ID      3
     Number_of_Ammos      41
          Ammo_id      1
          Number_of_Ranges      10
               Range    Cov      EU       HU       Crl      FE
               0         1.0     1.0      1.0      1.0      1.0
               100       1.0     1.0      1.0      1.0      1.0
               200       1.0     1.0      1.0      1.0      1.0
               300       1.0     1.0      1.0      1.0      1.0
               400       1.0     1.0      1.0      1.0      1.0
               500       1.0     1.0      1.0      1.0      1.0
               600       1.0     1.0      1.0      1.0      1.0
               700       1.0     1.0      1.0      1.0      1.0
               800       1.0     1.0      1.0      1.0      1.0
               900       1.0     1.0      1.0      1.0      1.0
```

Figure 10: Body Armour Protection_Probabilities

111. **Handcuff_ID.** Handcuff_ID is a new unit parameter in CAEn version 5.1, which applies to units when the civilian component of the simulation is used. The handcuff_id is used to identify various types of handcuffs listed in the Handcuff_Index.Data file in the Unit Data files directory. Each handcuff data file defines a unit's probability of resisting or not resisting the application of a defined type of handcuff. This parameter is not used by the military database but a value of 1 will be inserted in all infantry unit data files.

112. **Immunity_ID.** Immunity_ID is a new unit parameter in CAEn version 5.1, which applies to units when the civilian component of the simulation is used. The immunity_id is used to identify toxic immunity data listed in the Immunity_Index.Dat file in the Unit Data files directory. Each immunity data file defines the unit's immunity to specific toxic agents. This parameter is not used by the military database but a value of 1 will be inserted in all infantry unit data files.

113. **Fratricide_ Range**. This parameter is used to define the minimum safe distance range for small arms fire. Values of 300m seem to be reasonable for rifles and 400m for machine guns. This is based on military judgement and the standard value contained in the British CAEn functional data.

114. **Fratricide_ Probability**. This parameter is used to define the probability of attaining a false acquisition on a friendly unit. No specific data could be found with regard to this parameter. Because the Janus database does not contain any data, the value selected has been chosen based on discussions with the ORD military staff and on the assumption that well trained soldiers and especially snipers will follow battle drills and exercise caution before opening fire on a target that has not been identified. Accordingly, a probability of 10% seems appropriate for infantry units with the exception of snipers, which have a much lower probability.

115. **Infer_TA_Range.** This parameter is the range below which detected enemy units can be acquired by their proximity to other visually acquired units. A review of two sets of British CAEn functional data generally indicates that a 0.0 value has been inserted for the majority of units. Additional information and clarification concerning this parameter have been requested from the British CAEn development team. Pending this reply all units in this database have been assigned a 0.0 value for this parameter.

116. **Max _TA _Time**. This is the maximum time that a unit is prepared to spend trying to acquire a given detected target. No data is available but a review of British CAEn functional data for infantry units suggests a value of 10 seconds. Accordingly, this value has been used and is applicable to RED and BLUE units.

117. **Reflectivity**. This is the amount of light reflected off the unit. It is used together with the reflectivity of the background as a measure of contrast in the visual detection model. No indication of how reflectivity is calculated/measured is given. Based on advice from the British the reflectivity value for individual soldiers has been set at 0.081 for Blue and Red infantry units while units with crew served weapons have values that are lower. Why there is a significant difference in values is not readily apparent.

118. **Hidden Unit.** This is a new parameter, which is used only by the CAEn civilian database. A TRUE/FALSE response is required. For the ORD military database a FALSE response will be inserted.

119. **Target_Selection _Rule**. This parameter is not currently used but a value of 1.0 must be inserted.

120. **Supp_ Decay_ Rate**. This is the amount by which the unit suppression level will drop each second. See Section 9.2 of Ref 21 for a description of the unit suppression model. No data sources could be located. A review of the British CAEn functional data suggests that a suppression level decay rate of 0.5 is appropriate for infantry units. This value has been used and is applicable to RED and BLUE units.

121. **Max_ Supp_ Level**. This parameter defines the maximum value that the suppression level is allowed to reach. Again, no data sources are available and the British team suggested values greater than 10 should not be assigned for infantry units. British CAEn functional data uses a value of 10. British functional data has been used and is applicable to RED and BLUE infantry units. See also paragraphs 129-130.

122. **Posture_Bubble.** Posture_Bubble is a new methodology in Version 8.1 for determining if a round passing by a unit will cause suppression and, if so, how much the suppression dose will be in azimuth and elevation. It is the volume around a unit in different postures through which a bullet has to pass to cause a suppressive dose to be delivered. This parameter applies to all types of unit including helicopters. Data for this parameter has been very difficult to locate. For the ORD CAEn database, British functional data has been used.

123. **Illumination_Threshold**. This is the threshold level of luminance that a unit must have before it considers itself to be illuminated. As before, the British suggested to use the values in their

functional data. Accordingly, the British value of 0.2915 has been used and is applicable to RED and BLUE infantry units. Note that vehicle data does not include this parameter.

124. **Peripheral_Range**. A unit is in peripheral illumination when it is outside the effective range but inside a radius equal to the sum of the effective radius and the peripheral range. No data sources could be located. However, based on military judgement and Canadian ammunition technical data for ammunition that produces illumination, a value of 100m has been used.

125. **Ignor_Illum_TA_Range**. This range is used as a panic range such that a unit will continue to engage a target instead of aborting to its illuminated activity. No data sources could be located. British functional data has standardized on a range of 30.0 m. This value has been used and is applicable to RED and BLUE infantry units.

126. **Thinks_Itself_Det_ Recovery_Time**. This parameter relates to the unit suppression model. If a unit receives suppressive fire from nearby, it may consider itself detected. If no further increase in suppression occurs for this recovery time, then the unit will consider itself undetected again. No data sources could be located. Review of British CAEn functional data shows a standard value of 60 seconds. British data has been used and is applicable to RED and BLUE infantry units. Note this parameter is not used for vehicles.

127. **Number_of_Priority_Levels**. CAEn is structured such that it is possible for the simulation to invoke specially identified activities to respond to certain types of events without any initial player interaction. For example, as suppression on a unit caused by proximity to bullet or HE rounds reaches previously defined suppression thresholds, the simulation may cause the unit to suspend its current activity and undertake an activity to react appropriately to the suppression. In fact, the scenario situation at any given moment may be such that several events happen simultaneously, e.g.: a unit could be cutting wire while being under direct fire suppression and/or HE fire suppression. In the unit data files, there are several data blocks beginning with the "Number_of_Priority_levels" data block, which define or set conditions to invoke non-player initiated activity responses. The priority_levels data block defines in a descending priority importance list, the generic types of activities/events in a scenario to which the simulation will invoke from a predetermined list of activities a non-interactive activated response to act appropriately when specific conditions or events occur. Based on discussions with the British, up to eight user defined priority levels associated with various simulation modules listed below may be assigned in descending order of priority. The simulation contains eight modules, which may cause the invocation of a non-interactive initiated

response through the selection of an appropriate activity from a list of activities (See DOR(J&L) Research Note RN 9808, CAEn database Documentation v1.0, Volume Two, Notes on Behaviour Files (Ref 40) for additional information concerning simulation invoked activities). The eight modules are:

a. Firepower suppression module

b. Undetected illumination module

c. Detected illumination module

d. Peripheral illumination module

e. Anticipated illumination module

f. Reaction to encountering wire module

g. Reaction to encountering mines module

h. Fighting in buildings module

128. When an infantry unit is affected adversely by enemy action in relation to one of the modules listed above, the model will invoke, when specified thresholds are reached or are selected, e.g. fight in buildings, a unit activity sequence to reduce, avoid, or deal appropriately with the circumstances in preference to the activity currently being performed by the unit affected. Situations can arise when the simulation may wish to activate two or more sequences simultaneously when it is possible for only one activity at a time to be invoked and subsequently processed. In order to resolve this type of conflict the user must define the order in which the simulation will react to the above modules for each infantry type unit in the scenario database. The priority list is used by the simulation to resolve activity selection conflict problems among the eight modules. The user-definable priority list should be reviewed for every scenario prior to scenario generation to ensure that the priorities established are valid for that scenario. The priority list may also have to be changed depending on whether the scenario is a day or night scenario. See Figure 11, which is an example of a Priority Levels data block. Once the reaction priorities have been defined the specific responses to each are then defined as described below.

```
Number_of_priority_levels 8
      top_priority        supp_fire_power
      next_priority       react_to_mines
      next_priority       undected_illumination
      next_priority       react_to_wire
      next_priority       detected_illumination
      next_priority       peripheral_illumination
      next_priority       anticipated_illumination
      bottom_priority     fight_in_building
```

Figure 11: Priority Levels Data Block

129. **Number_of_Supp_Levels.** A review of British unit data files shows that infantry units usually have two suppression levels although there could be fewer or more levels. Suppression levels can be caused by many sources, but in most instances it is the result of enemy direct and indirect fire. Note that suppression is accumulative through suppression thresholds. For ORD purposes, suppression levels on infantry units are set as illustrated below in Figure 12.

```
      number_of_supp_levels    2
      supp_level_1             0.0   8.0    0
      supp_level_2             8.0  10.0    5
```

Figure 12: Suppression Levels

130. For each suppression level, the first two numbers define suppression levels or thresholds. The third number is the identifier of the activity sequence, which will be invoked as a response by the unit to deal with the suppression when the suppression level falls between or reaches one of the defined suppression levels. An activity identifier of 0 specifies that a unit will carry on with its current activity. As recommended, the suppression levels do not overlap nor exceed the max supp level of 10.0 (see also paragraph 121). In the example above, the unit will start the activity defined by activity identifier 5 if its suppression level is between 8.0 and 10.0.

131. **Illumination_Acts**. Responses associated with units encountering illumination, which is another type of suppression, are defined in a data block following the definition of suppression levels. The first column of the data block, see Figure 13, lists the illumination events, while the second column contains activity identifiers of the activity that will be non-interactively invoked by the simulation. This way, a unit encountering one of the illumination events in the list will respond appropriately. The activity responses are user definable from the activities in the Activities Index remembering that any activity selected must be a logical response for a specific illumination event.

```
undetected_ill_act          65
detected_ill_act            65
peripheral_ill_act          65    response activity identifiers
anticipate_ill_act          65
get_up_and_run_act          88
```

Figure 13: Illumination Activities Responses

132. **Number_Of_Wire_Acts and Number_Of_Mine_Acts.** The "wire_cutting_act" and "mine_breaching_act" parameters in version 3.2 data files are no longer used in CAEn versions 5.1 and 8.1. It is now possible to define different responses when encountering different types of mines and wire as advised in Ref 31. As a result, new parameters with new data fields have been included as illustrated below in Figure 14.

```
number_of_wire_acts     2
wire_reaction_act       1     54    87
wire_reaction_act       2     54    87

number_of_mine_acts     2
mine_reaction_act       1     84    84
mine_reaction_act       2     85    85
```

Figure 14: Wire and Mine Responses

133. In the above examples two reactions to encountering wire and mines are specified. Note that more that one reaction can be specified. The number after the "wire or mine_reaction_act" refers to the type of wire or mine encountered: i.e. "1" in the second line could reference bar mine and the "2" in the next line could reference anti-personnel mines, as defined in the wire and mine data files. The next two columns contain activity index identifiers. The first identifier is the identifier for the activity sequence the unit encountering the wire or mine will non-interactively invoke to react to the wire or mines. The second identifier is the identifier for the activity sequence the other units in the group will non-interactively adopt in response to the wire or mines. Thus it is possible to define different reactions to different types of wire and mines. It is also possible that the reactions of the unit encountering the obstacle and the remaining units in its group could be the same but more likely they will be different. The activity responses are user definable from the activities listed in the Activities Index remembering that any activity selected must be a logical response. These parameters should be reviewed prior to scenario set up so that appropriate responses based on scenario requirements can be defined.

134. **Weapon_Sharing_Act.** The activity index identifier for the activity sequence which, will be invoked by the simulation to cause a unit to undertake a weapon sharing activity, is inserted after this heading.

135. **Pickup_Weapon_Act.** The activity index identifier for the activity sequence, which will be invoked by the simulation to cause a unit engaged in a weapon sharing activity to pick up another weapon, is inserted after this heading.

136. **Fight_in_building.** The activity index identifier for the activity sequence, which keys the simulation to invoke the special fighting in buildings model, is inserted after this heading. This parameter is redundant in version 8.1 because it is now possible to fight in buildings interactively. An activity index identifier is still required.

137. In the infantry unit data files a series of new parameters as listed below in Figure 15 have been added. They are used by the civilian component of the model and are not used by the military database. However, responses are required in the military database even though they are not used. The parameter responses in the example below will be used in the ORD military database.

```
Building_avoidance      False

more_obviosness_time      2.0
generic_vulnerability     2.0
start_time_aggression  docile
start_time_fear        calm
start_time_abilities   1 normal_abilities
melee_wpn_ag           more_aggressive_no_diff
melee_wpn_fr           more_afraid_no_diff
melee_wpn_prob         0.0
generic_melee_method   r_fear_n1_aggression
generic_melee_targ     melee_rnd_closest_involved
push_radius            0.25
push_strength          0.1
push_ag_effect         more_aggressive_as_strong
push_fr_effect         more_afraid_less_radius
pull_strength          0.1
pull_ag_effect         more_aggressive_as_strong
pull_fr_effect         more_afraid_as_strong
debuss_ag_effect       more_aggressive_as_quick
debuss_fr_effect       more_afraid_as_quick
```

Figure 15: Civilian Database Parameters

NOTES TO VEHICLE UNITS

138. Unless otherwise specified the data values apply to RED and BLUE vehicle units. Please refer to Annex B for examples of tank and APC data files.

139. **Temperature.** A common value of 17 degrees Celsius has been selected for both RED and BLUE vehicle units pending further consideration of this parameter.

140. **Max and Min Gradient.** These are new parameters in Version 8.1, which apply only to tanks and APCs, particularly to vehicles with a turret containing a weapon. The max and min gradient refer to the maximum and minimum elevation/depression to which vehicle main armament can be raised or lowered. The gradient values are expressed in radians. Where no reference was available for a specific vehicle, data was surrogated from the closest similar type of vehicle system.

141. **Debus_time.** These are parameters, which only apply to vehicles able to carry passengers, such as APCs. They do not appear in tank data files. The various timings for embussing and debussing have been estimated (see Figure 16). The embus_limit field controls the maximum number of units permitted to embuss in the vehicle. In the "p_kill_embussed" parameter a 0.0 value will be inserted pending the availability of scientifically reliable data. The "p_kill_embussed" field is the probability that the unit(s) inside a vehicle are killed when the vehicle is penetrated by a round of ammunition. Until reliable data is available for this parameter, no probabilities will be defined.

```
debus_time          7.0
min_debuss_time     5.0
embus_time         10.0
max_embus_time     60.0
embuss_limit       10.0
p_kill_embussed     0.0
```

Figure 16: Embuss and Debuss Timings

142. **Entity_type and Activity_Num.** Vehicle units may now have up to four "entities" that can observe from inside the vehicle. These four entities are: the gunner, the weapon loader (if there is one), the vehicle commander and the vehicle driver. The gunner entity initially uses whatever observation activity, e.g. HOLDFIRE, that is assigned in the Unit Data menu during scenario

deployment. This initial activity can subsequently be altered interactively during scenario play. The other three entities – commander, loader and driver – should be assigned default observation activities under this heading on the "activity_num" line during deployment. For ORD purposes, the default activity when assigned is activity_id 26, HOLDFIRE. It is not necessary to assign a default activity to the commander, loader, or driver if the scenario does not require that all or any of them be able to observe. In cases where any entity is not required to observe a "0" is entered under the entity heading. Unlike for the gunner, once a default activity or a "0" has been assigned for any of the three other entities during deployment it is not possible to interactively change these during scenario play. In addition, sensors must not be defined for any entity, which has a "0" in its column of the activity_num line. Using this methodology, individual entities are now capable of carrying out entirely separate surveillance processes so that from the vehicle, different sensors look in multiple directions and carry out target acquisition while the gunner (main entity) carries out other activities. All surveillance detections and target acquisitions from other entities are automatically passed to the gunner so that the gunner can be ordered to fire on a target which was first acquired by the commander for example. Lastly, it is very important to remember that for any entity defined as able to observe, there must be at least one sensor defined in the number_of_sensors block.

143. **Entity_Speed_Lookup**. See the explanation of this parameter in the Infantry Units data files, paragraph 87.

144. **Veh_Speed_Type**. This parameter is similar to the "Inf_speed_type" but uses four speed graduations: STOPPED, CREEP, CONVOY and FULL SPEED, as illustrated in Figure 17. The data Users Guide does not define CREEP speed but it obviously is meant to be a slow cautious movement. Making that assumption and assuming that a creeping vehicle likely will be doing so accompanied by dismounted infantry, it would seem reasonable that the vehicles will be going no faster and possibly slower than the dismounted infantry. Therefore, CREEP speed is defined in terms of walking infantry and the infantry unit walking speed of 1.9 m/sec is used. Note that this value is very close to speeds in the British functional data available. The value for this speed is the same for RED and BLUE vehicle units. Convoy speed is based on data from B-GG-005-014/AF-030, Movement Volume 3 – Road, June 2000 (Ref 18). One convoy speed for all vehicles has been established. Section 2, Table 2-1, good roads, has been used to determine this value. It was selected as an average speed that modern vehicles of all types could maintain in convoy. All speeds are expressed in meters per second. Ref 8 was consulted with regard to threat convoy speeds.

veh_speed_type	stopped	creep	convoy	full_speed
vehicle_speed	0.0	1.9	9.16	18.05

Figure 17: Vehicle Speeds

145. **Acceleration**. Prior to Version 8.1, vehicles would attain their maximum speed as soon as they departed a node or were restarted along an existing route. In Version 8.1, functionality has been added to enable all vehicle units to accelerate up to the speed type maximum that has been ordered interactively. When a stationary vehicle is ordered to move, it is assigned an immediate finite speed of 0.01 m/s. A vehicle will accelerate each time the theoretical speed to be attained is greater than the current speed. This process is repeated until the calculated current speed exceeds the theoretical speed, at which point the current speed is set to the theoretical speed. Note that acceleration is not applicable to infantry units. Deceleration of any unit is not considered – units will stop instantaneously. Acceleration due to a change in direction, e.g. turning a corner, including large angles, is not taken into account either.

146. **Gradient_Deg_and _Speeds.** See the explanation for this parameter set in the Notes for Infantry Units, paragraph 90, which is applicable.

147. **Terrain_Type.** Water is the only category defined for this parameter. See also paragraph 91.

148. **Terrain_speed.** A value for unit speed through water is defined. Note that a value of 0.0 can be inserted to prevent a unit from passing through the water.

149. **Terrain_ Speed_Culture_Type**. See the explanation for this parameter set in the Notes for Infantry Units, paragraph 92, which is applicable. For urban type terrain speed, the British have advised that for all urban terrain types the speed for vehicles should be set to 0.0. This is done to prevent vehicles from driving through buildings. Vehicles can move through urban terrain but movement must be between buildings.

150. **Cover_State**. Vehicles only have one "cover_state", that is, FULLY EXPOSED. However, all data elements in the Posture State Table must be filled in and this is done by inserting the FULLY EXPOSED value in the remainder of the table, as illustrated below:

cover_state	fully_exp	fully_exp	fully_exp	fully_exp	fully_exp
Unit_height	2.62	2.62	2.62	2.62	2.62
Unit_width	3.37	3.37	3.37	3.37	3.37
Unit_length	7.09	7.09	7.09	7.09	7.09
Sensor_height	2.59	2.59	2.59	2.59	2.59

Figure 18: Cover States

151. **Number_of _Sensors**. Having defined which entities (commander, loader, driver) in a vehicle will be given a capability to observe (see paragraph 142), it is then necessary to define which entity is capable of using any sensor on board the vehicle from those available and whether that sensor is linked to the turret or vehicle direction. Any sensors the unit (vehicle) "inherits" by virtue of the weapons the vehicle carries are automatically assigned to the gunner and limited to the turret direction.

152. An observation arc can be set in graphics and deployment for the gunner (vehicle/weapons), which defines where the gunner concentrates his surveillance. This arc can be changed interactively during scenario play. The arcs of any other entities defined in the vehicle unit file carry out observation on all areas not included within the gunner's arc to provide all round surveillance. These arcs are present in the simulation graphics code and cannot be defined or changed interactively in either deployment or gaming modes of the simulation.

153. If the field_of_view (FOV) for any vehicle is selected, all of the current FOVs for the sensors defined for the vehicle entities are displayed simultaneously on the screen graphics for that vehicle, that is, if sensors have been defined for all four entities, then four FOVs will be displayed. The length of the FOV arcs define which entity is which as follows:

a. Commander's arcs are 20 m long

b. Gunner's arcs are 40 m long

c. Driver's arcs are 10 m long

d. Loader's arcs are 7m long.

154. These are initially a bit difficult to discern on lower screen zooms, but with practice and experience distinguishing among them becomes much easier. If a sensor view is activated the simulation automatically defaults to the gunner's FOV and surveillance arc when drawing the sensor view.

155. Figure 19 illustrates the file format for the number of sensors. In this example, the driver is able to use sensor 4, which is fixed to the vehicle direction and independent of turret direction (the last two columns). The gunner is able to use sensor 5, which is independent of both vehicle and turret direction. The commander has two sensors – sensors 2 and 3. Sensor 2 is independent of both vehicle direction and turret direction while sensor 3 is independent of vehicle direction but is dependant on turret direction. The loader can use sensor 1 which is independent of both vehicle and turret direction.

```
number_of_sensors     5
sensor_id             1       loader      FALSE    FALSE
sensor_id             2       commander   FALSE    FALSE
sensor_id             3       commander   TRUE     FALSE
sensor_id             4       driver      FALSE    TRUE
sensor_id             5       gunner      FALSE    FALSE
```

Figure 19: Number of Sensors

156. In order to achieve this functionality the vehicle turret must be able to rotate. The maximum speed of rotation of the vehicle turret is expressed in radians per second. Only the gunner is able to rotate the turret and may do so by a maximum of the turret speed in any one change of direction. Other entities making use of turret sensors must use them in relation to the direction the gunner currently has the turret facing although the size of their FOV may be different.

157. In order for the gunner to fire a weapon, the turret must be facing in the firing direction. If the turret must rotate to face in the firing direction in order to fire, a delay time is added to the aim time of the weapon according to the degree of rotation required. When the weapon fires, the turret direction will be set to the firing direction.

158. **Turret_rotation**. The value inserted in this parameter sets the maximum speed of rotation of the turret in radians per second.

159. **Number_of_Weapons**. In this database, tanks and infantry fighting vehicles usually have two or more weapons (main gun and coax gun) while transport APCs usually only have one weapon. Vehicle air defence weapons will be included when Helicopter units are incorporated into the database.

160. **Loaded and unloaded rounds.** See paragraphs 104 to 106 in the Notes for Infantry Unit Data Files, which are applicable.

161. **Target_type_ID.** All Target_Type_IDs defined in paragraph 108 are applicable for both RED and BLUE vehicle units, except for Target_Type ID 1.

162. **Mine_Target_Type_ID.** See paragraph 109 of the Notes for Infantry Units, which is applicable to vehicles as well.

163. **Armour_ID.** This is a new parameter in the version 8.1 military database. It is the same as the body armour_id in the infantry unit data files. This parameter allows the user to define, for instance, different types of Explosive Reactive Armour (ERA) or other kinds of armour, which increase the ability to resist or prevent penetration of the vehicle when a round strikes the vehicle. For example, armour_id 1 could define a certain type of ERA while armour_id 2 could define a type of non-explosive add on armour. For each "armour" defined there must also be "protection probability files" which are defined in the Body Armour File. The Body Armour File defines protection capabilities against various ammunition types for both infantry and vehicle units. See also paragraph 110 in the Infantry Unit Notes.

164. **Handcuff and Immunity_IDs.** These parameters are not used by vehicle units but a value of 1 is inserted.

165. **Fratricidal_Range**. British functional data shows that a value is entered which corresponds to the value for infantry units, i.e.300m.

166. **Fratricidal_Probability**. British data indicates a 0.0 probability for tanks while for some APC vehicles a small probability has been assigned. It is assumed that the logic here may be that since vehicles have more sophisticated sensors than humans it will be easier to identify friend from foe hence preventing a fratricidal engagement. In addition the size of the vehicle will reduce the chances of fratricide. Note that no data could be located.

167. **Max _Target_Acquisition_Time**. A review of British functional data suggests a value of 10 seconds is applicable. Since no other data is available this value has been used.

168. **Reflectivity**. See Infantry Unit comments contained in paragraph 117. No data sources were available. Until other data is available vehicles have been assigned a value of 0.105 based on information received from the British.

169. **Hidden_Unit**. See paragraph 118 in the Infantry Unit Notes, which applies.

170. **Run_over_capability**. Vehicles in Version 8.1 are able to run over infantry units, thereby causing them to become a casualty. Unless otherwise required, a TRUE response, which enables vehicles to run over infantry, will be inserted for all vehicle units in the ORD database.

171. **Target_Selection_Rule**. Not used but a value of 1 is entered.

172. **Suppression_Decay_Rate**. No data sources have been located. A review of British functional data shows a variety of values ranging from 0.0 to values greater than one. Paragraph 15 of Ref 19 provides a detailed explanation of this parameter.

173. **Maximum _Suppression_ Level**. No data sources were located. See paragraph 15 of Ref 19, which states a value of 0.0 should be used.

174. **Posture Bubble**. See the Infantry Unit Notes paragraph 122. Since armoured vehicles are not that susceptible to suppression, the data of any infantry unit could be inserted or another way is to enter 0.0 values in all data columns of this parameter. The second method may be more applicable since it is difficult to cause suppression on vehicles. For the ORD, 0.0 values will be used.

175. **Number_of_ Suppression_Levels**. A review of British data indicates that vehicles have one suppression level and that 0.0 values are entered in the three columns (see Ref 19, Paragraph 15). This convention has been followed.

176. **Number_Of_Wire_Acts.** As for infantry units it is now possible to define different responses for vehicles encountering different types of wire.

177. **Number_Of_Mine_Acts.** As with infantry units the number_of_mine_acts can be defined based on scenario requirements.

178. **Wire_Reaction_Act and Mine_Reaction_Act.** As with infantry units it is now possible to define different responses to different types of wires and mines. See paragraphs 132 to 133 in the Infantry Unit data notes, which explain this in more detail.

179. **Weapon_Sharing_Act.** This parameter is not used for vehicle units but an activity_id is required even though it is not used. In the ORD database activity_id 63 is used.

180. **Pickup_Weapon_Act.** As above, activity_id 64 is used.

181. **Fight_In_Building.** As above, activity_id 3 is used.

182. Three new parameters have been added at the end of the CAEn 5.1 and 8.1 vehicle data files as illustrated in Figure 20. Once again these are parameters used by the civilian database but not the military database. However, text response or numerical values are required and the ones illustrated below will be used in all vehicle data files of the ORD CAEn database.

```
Building_avoidance      False

push_radius              5.0
push_strength            1000000.0
```

Figure 20: Building avoidance, Push_Radius and Push_Strength

NOTES TO WEAPON DATA FILES

183. The following are notes, which explain or amplify entries or values in the various weapons data files. See Annex C for the list of all CAEn weapons and Annex D for examples of weapons data files. Data for some parameters have been very difficult to locate and this has resulted in selection of values based on military judgement and experience or use of British functional data that is known to be approximate only. No notes are made for parameters, which are straightforward and clearly defined in the CAEn Data Users Guide.

184. **Weapon Transferable**. This parameter governs whether a weapon can be transferred from one unit to another through the weapon sharing / weapon pick up functionality defined in the unit data file format. A TRUE response allows the weapon to be transferred. A TRUE response is also required if a weapon has been included in an ammo_dump. The majority of small arms type weapons can be transferred (i.e. shared) while it is obvious that vehicle and helicopter main armaments cannot.

185. **Weapon_Fire_From_Building.** A FALSE response has been entered for weapons which cannot be fired from inside a building, for weapons, which it is illogical to fire from inside a building, even though it is possible and for weapons that would not usually be fired from within the building because of limitations due to characteristics of the weapon. Examples of weapons in the above categories are indirect fire weapons and weapons, mainly anti-armour weapons, which have large and pronounced back blast areas. This parameter could be changed to TRUE for specific weapons required for any particular research study.

186. **Multi_Nature_Weapon**. Queries concerning this parameter have been sent to the British CAEn development team. We are still awaiting a response.

187. **Weapon_disarm_mode.** This is a new weapon parameter in CAEn Version 5.1. It is used when the civilian database is used but a text response is required. From an examination of British functional data, it appears that a text response of "on_disarm_use" has been inserted for this parameter. This convention has been followed in the ORD database. This parameter is applicable to both direct and indirect fire weapons.

188. **Prerequisites.** This is a new weapon parameter in version 5.1 which is used in the civilian database. A numerical value is required for the military database. From an examination of British functional data it appears that a "0" value has been inserted for this parameter. This convention has been followed in the ORD database. This parameter is applicable to both direct and indirect fire weapons.

189. **Possession_prob.** This is another new parameter in version 5.1 used in the civilian database for which a numerical value is still required for the military database. From an examination of British functional data it appears that a value of 1.0 is inserted for this parameter. This convention has been followed in the ORD database. This parameter is applicable to both direct and indirect fire weapons.

190. **Pickup_range.** Values for Pickup_ range have been determined based on military judgement with regard to the relative importance of the weapon to be picked up. The more important the weapon in terms of contribution to the close-in battle, the greater the distance of the pickup range value while the less important contributors have received lower values. The logic is that soldiers would risk moving greater distances to retrieve high value weapons than lower value contributors. Weapons, which are not to be picked up, have been assigned 0.0 values. See Ref 20 p 20. No data sources were located.

191. **Aim_Time_Max And Aim_Time_Min**. The Janus Weapons Characteristics file is the primary source for these parameters. The aim_time_max parameter is the sum of the Janus Lay_time and Interin_firing_time parameters. The Janus Database Manager's manual contains definitions of these parameters. The resulting timings are a bit conservative, i.e. slow and may disagree with other data sources, which generally state quicker times. However, military judgement in ORD supports slower timings based on the fact that things generally take longer than expected in operations. The CAEn Data Users Guide states that the Aim_time_min parameter is not currently used (See p 20). However, a value has been entered which is the Janus Interim_firing_time value. See also paragraph 12 of Ref 19.

192. **Max_and_Min_Aim_at_Range**. Max_aim_at_range and Min_aim_at_range are new parameters in Version 8.1. It appears that these parameters are mainly used for small arms weapons inside buildings. These parameters represent the ranges to a 1m target that require the maximum and minimum time, respectively, to aim at that target. In order to determine the aim time for other targets,

the simulation converts these ranges into angles based on the arc subtended by the 1m target at the ranges specified. CAEn compares these angles against the angular size of an aim zone or surveillance zone to calculate an aim time (see Ref 36, section 7.4.2.1). No data sources could be located to provide data for these parameters. Therefore, values for the various weapons in the ORD database are based on best military and scientific judgement until reliable data can be located.

193. **Sensor_ID**. Sensor_ID defines the sensor identifier that is connected to the weapon. This is the sensor that will be used to aim the weapon during the firing process. In the case of rifles with iron sights or hand grenades where the weapon will be aimed and fired using eyes, the sensor identifier for the eyeball sensor should be used. Indirect fire weapons when used in the indirect role where they cannot see their targets still require a sensor. A special type of sensor for these types of weapons has been developed. This is sensor_id 2, Null or IDF sensor. However, should the vehicle have both a direct fire and indirect fire capability then the weapon should be assigned a sensor which will permit it to fire in the direct fire role. Assigning an appropriate direct fire sensor will still permit the weapon to be fired in the indirect fire role.

194. **Direct Fire and Supp Fire IDs.** The direct_fire_act_id is the identifier of the activity that can be used to aim and fire the weapon in a direct fire role. The supp_fire_act_id is the identifier of the activity that can be used to aim and fire the weapon in an indirect fire or suppessrive fire roles.

195. **Noise_Range and Noise_Angle**. The noise_range is the range below which enemy units can achieve a noise detection of the weapon when it is fired. No data sources could be located for these parameters. Values for noise ranges are based on military judgement using a general rating scale based on the louder the bang of the weapon, the higher the noise range. The noise angle is the angle of the noise detection arc displayed on players screen. A value of 0.4 is a standard for noise angle for all weapons. The choice of this value was the result of a review of British CAEn functional data.

196. **Fire_speed**. This new parameter in Version 8.1 is used by all weapons included in the database. The fire_speed field sets the minimum speed in meters per second at which the "fire_on_move" and "aim_on_move" parameter values are considered. If the actual speed of the unit is less than the "fire_speed" then a TRUE response is assumed for both values. In the ORD database, the fire_speed values for infantry weapons which can be fired on the move has been set the same as for the "slow speed" values in the unit file while for vehicle weapons the value has been set the same as for the "convoy" speed values in the unit file (See Ref 37, section 4.1.2).

197. **Fire_on_move**. This new parameter in Version 8.1 is used by all weapons included in the database. A TRUE or FALSE response is entered. If the weapon can easily be fired on the move, a TRUE response is entered while a FALSE response is entered for weapons which cannot be fired on the move or for which it would be difficult or impractical to fire on the move even though it could be possible to fire the weapon while moving.

198. **Aim _on_Move**. This new parameter in Version 8.1 is used by all weapons included in the database. A TRUE or FALSE response is required. If the weapon can be aimed on the move a TRUE response is entered and if the weapon cannot be aimed while moving a FALSE response is entered. Generally, vehicle main armaments and coaxial sub weapons can be aimed on the move while infantry small arms and anti-armour weapons are not.

199. **Number_of_Ammos**. Some weapons can have multiple types of ammunition. Note that for some weapons not all of the ammunition capable of being fired by that weapon has been included in the database, particularly if the ammunition is not in Canadian stocks or if the selection of ammo types is so large it is impracticable or, possibly wise, to do so. Generally, the most common types of ammunition fired for any specified weapon have been included.

200. **Load _Capacity**. Load capacity is the maximum number of rounds of each type specified in the weapons file, which are capable of being loaded in the weapon at any time. For rapid firing weapons such as small calibre cannon and machine guns, load capacity is a full belt of ammunition or a full magazine if the weapon uses a magazine. For some weapons, reference sources indicate that multiple or linked belts are available as ready ammunition. In these cases the amount stated has been entered. For this database, small arms ammunition belts for 7.62 mm ammunition contain 105 rounds while 12.7 mm belts contain 220 rounds. This convention also applies to RED ammunition unless a specific reference indicates otherwise.

201. **Load_Time**. Load time is the time required to load the weapon to its full capacity as specified above. Reload time values from the Janus Weapons Characteristics file have generally been used.

202. **Burst_Number.** For quick or automatic firing small arms, ORD has defined burst as the number of consecutive rounds required to achieve a kill. Hence, the burst for small arms has been defined as 5 rounds and this value has been used for all automatic firing small arms. A burst of three rounds for small calibre cannons, unless reference sources indicate otherwise, has been used.

203. **Number_Trajectory_Elements.** In this section of the weapon data files a number of data elements for general categories of bullets, AP warhead, HE warhead, smoke warhead and flare warhead need to be defined. For bullets, the trajectory requirements are in 50m increments for the range of the weapon. For other ammunition the requirement seems to be enough trajectory elements to describe the path of the projectile fired. Data sources for these elements were not readily available. For most weapons velocity information only consisted of values for the initial muzzle velocity. Values for loss of velocity over increasing range were generally not available. Time of flight values were in some cases calculated using muzzle velocity as constant velocity for all ranges and hence at longer ranges calculated values are only approximate and of shorter duration than they may actually be. The range and azimuth error values for HE, smoke and flare warheads come from Janus Munitions Data, dated May 30, 1997, Ref 11. Data for the various errors associated with bullets is in most cases the values in the British CAEn functional data. These values have been used until Canadian data is obtained. Figure 21 is an example of a trajectory elements table for bullet type ammunition.

number_traj_elements 12

range	velocity	elevation	ToF	range_error	az_error
0	935.0	0.000	0.000	0.000	0.000
50	882.3	0.299	0.055	0.000	0.000
100	831.1	0.628	0.114	0.000	0.000
150	781.3	0.987	0.176	0.000	0.000
200	732.9	1.355	0.242	0.000	0.000
250	686.1	1.769	0.312	0.000	0.000
300	640.7	2.221	0.388	0.000	0.000
350	596.6	2.719	0.469	0.000	0.000
400	554.0	3.263	0.555	0.000	0.000
450	512.9	3.869	0.649	0.000	0.000
500	473.5	4.546	0.751	0.000	0.000
550	435.8	5.306	0.861	0.000	0.000

Figure 21: Trajectory Elements

204. Versions 5.1 and 8.1 contain new trajectory error parameters as follows:

a. Acc_Range. This relates to the accuracy error of indirect fire weapons in range. This

error is applied to the first round of indirect fire. It represents the standard deviation in meters.

b. Acc_Line. This relates to the accuracy error of indirect fire weapons in line. This error is applied to the first round of indirect fire. It represents the standard deviation in meters.

c. Con_Range. This relates to the consistency error of indirect fire weapons in range. This error is applied to subsequent rounds of indirect fire. It represents the standard deviation in meters.

d. Con_Line. This relates to the consistency error of indirect fire weapons in line. This error is applied to subsequent rounds of indirect fire. It represents the standard deviation in meters.

205. ORD requested information on these parameters from the British and the reply is contained in Ref 19. Zero values have been inserted where data for these new parameters were not available.

206. **FIBUA Firing Degradation Factors**. In Version 8.1, a new set of four degradation parameters, which apply to all weapons in the database, have been added. The four new parameters are:

a. Tol_zn_width

b. Tol_zn_length

c. Tol_zn_gradient (where gradient is either elevation or depression of the weapon)

d. Tol_zn_radius.

207. The data values for the above are used by the new FIBUA set of activities which have been developed for use when operating on urban terrain. The data values are multipliers that are used to degrade the standard firing accuracies to take account of the situation in which they are used. Although these multipliers apply to all weapons, their effects are most noticeable on infantry small arms firing inside buildings. When applied these multipliers reduce further the accuracy of the bullet

trajectory which will be degraded by other firing and ballistic errors contained in the weapons data files. Theses new parameters come directly after the ballistic data table for each weapon in the weapons data file. Data for these parameters has been difficult to locate. Until data is available, data contained in example files supplied with the simulation will be used (see Refs 36,37 and 38 which provide some insight into these parameters).

208. **Ballistic Damage**. Ballistic damage to buildings is caused when a round strikes urban culture, thereby damaging the surface and possibly penetrating through the surface causing additional damage. Two new parameters in Version 8.1, Building Penetration (Bld_Penetration) and Building Damage (Bld_Damage), have numerical values, which are used during the calculation of damage effects. Data for these parameters was not available. Because of this, CAEn technical staff has begun a series of tests to determine appropriate values for each type of ammunition and assistance has been requested from the CAEn developers. Until the tests are complete, values from example data provided with the simulation are being used (see Ref 36, section 5.6 which provides some insight into the function of these parameters).

209. **Large_Proj**. This new parameter in Version 8.1 is used to determine the outcome of the impact of a round against windows by allowing relevant values in other data files to be read to determine the outcome. This parameter applies to all types of weapon ammunition in the current ORD database. A TRUE/FALSE response is required with a TRUE response activating this parameter. Until testing with regard to the effects of munitions against buildings is completed this parameter will be set to FALSE in all weapons files so that it will not be used. There is very little information in Refs 36 and 37 concerning this parameter.

210. **Airbust_Shot**. This is a new parameter and its title can be a bit misleading in relation to what the term 'AIRBURST" means in military terminology with regard to certain types of indirect fire munitions. When activated, this parameter does cause some effects, which are similar in nature to HE, proximity fused rounds (airburst) but this function in CAEn does not model a true airbust round. This parameter applies to bullet ap_warhead ammunition and HE_nextgen ammunition. This parameter requires a TRUE/FALSE response. To activate this parameter, a TRUE response is set and this alters the way in which the bullet model code functions. If this parameter is set to TRUE, the round will detonate at the coordinates of the aim zone specified regardless of whether it hits a solid target in that aim zone. With the parameter set to FALSE the round will impact on any surface prior to reaching the specified aim zone but unless it strikes a surface in the aim zone it will pass through the aim zone and only stop when it strikes something. As a result, the point of impact may be

considerably beyond the point of aim (See Ref 36, section 5.10 and Ref 38 concerning this parameter). In the ORD database, this parameter will be set to FALSE until testing of this parameter is completed.

211. **HE Lethality Data Set**. After the ballistic data set is a data set for HE type munitions, which defines HE lethality against tanks, APCs and infantry targets. For infantry targets in different postures kill probabilities are defined over a number of user definable kill radii in open and wooded terrain as well as unfortified and fortified buildings. ORD has developed a methodology for calculating the kill probabilities, which is contained in Ref 34. All weapons files HE lethality data have been derived using this methodology. See Figure 22, which is an example of this data set.

Inf kill data	hiding	kneeling	crawling	crouching	standing
Number_of_kill_radii	1				
Kill_prob_open	1.0	1.0	1.0	1.0	1.0
Kill_prob_wood	1.0	1.0	1.0	1.0	1.0
Kill_prob_fu	1.0	1.0	1.0	1.0	1.0
Kill_prob_ufu	1.0	1.0	1.0	1.0	1.0
Kill_radius_open	6.2	6.2	6.2	19.5	19.5
Kill_radius_wood	5.0	5.0	5.0	15.7	15.7
Kill_radius_fu	2.4	2.4	2.4	2.4	2.4
Kill_radius_ufu	4.8	4.8	4.8	4.8	4.8

Figure 22: HE Lethality Data

212. **Azimuth_Rapid_Mult**. This is a new parameter in Version 8.1, which affects bullet type ammunition. This parameter is a multiplier, which is applied to the combined deviation caused by the standard error data before it is used to calculate an actual error (Ref 36, section 7.3.3 and 7.4.3). This parameter is only used if an activity containing the "set_bullet_accuracy" base activity has been selected for use. The "set_bullet_accuracy" base activity reduces the accuracy of a bullet trajectory. Data for this parameter has been very difficult to locate. Until further information is available and testing is undertaken a value of 2 will be used for this parameter.

213. **Elevation_Rapid_Mult**. The explanation for this parameter is the same as for paragraph above, Azimuth_Rapid_Mult. A value of 2 will also be used.

214. **Suppressive_dose_data_bullets**. In CAEn Version 8.1, an additional column of suppressive_dose_data is included which are used when combat takes place inside buildings. The values for the second data set can be the same as for the first or can be different. Until additional information is available and testing is completed, the supp_dose and expectation_time values will be double those in column one but the awarness_prob will be the same as column one. Figure 23 is an example of a suppressive_dose data set.

```
supp_dose              1.00   2.00
expectation_time       2.00   4.00
awareness_prob         1.00   1.00
```

Figure 23: Suppressive Dose Data Set

215. **Inf Kill data**. This is a new data set in Version 5.1. This is used only by the civilian database of CAEn. However, values are required in the military database. To meet this requirement, the values for the Inf kill data, first radius data set from the data set described above in paragraph 211, will be entered in all weapons files calling for this data set.

216. **Individual_Injury data.** This is a new parameter in version 5.1 that is used by the civilian database. Even though this parameter is not used by the military database a text response is required and is applicable to all direct fire weapons and HE ammunition fired from indirect fire weapons. The text response that will be used for all weapons data files is as follows:

"Individual_injury no_injury 1.0 -1.0 calm docile -1.0"

217. **Indirect Fire Suppression Data.** Just as bullets cause suppression so do the effects of exploding HE munitions. After the Individual_Injury data set, the Indirect Fire Suppression data set is defined. In this data set suppressive dose, expectation time and suppression radius are defined. Suppressive dose is the amount of suppression given to the target should the shell impact near enough to cause suppression. Expectation time is the time after the first impact that a target unit might expect another round from the same weapon to land. Suppression radius defines the proximity within which a round will cause suppressive effects. For HE ammunition, the values for suppressive dose and expectation time have been estimated based on military and scientific judgement or British functional data. Values for suppression radius are based on lethal area radii for different calibres of

munitions where lethal area data could be located. In other cases, values were estimated or surrogated from available information on similar munitions types. In Version 8.1, a second column of data has been added for use on urban terrain. Until further information is available and testing is undertaken, the data in the second column will be the same as in the first column.

218. **Smoke files**. The following types of smoke can be represented in CAEn: HC smoke, WP smoke and bispectral smoke. As noted in Ref 16, CAEn uses the same smoke data as the Janus simulation on 5x6 km CAEn terrain but this data must be modified to scale it for use on 1x1 km CAEn urban terrain. The smoke file contains the data, which defines the behaviour of the smoke cloud produced for each type of smoke ammunition. Two new data fields have been added in the Version 8.1 smoke data file as follows:

a. Optical_reflectivity. This is a new field in the smoke data file. No data for this parameter could be located. Until reliable data is available a value of 0.122, which comes from British functional data will be inserted.

b. Toxicity: This parameter is only used by the civilian database but a value is required. For purposes of this database value of 0.1 will be used, which is the value that appears in data format examples.

219. **Special Damage Effects**. Special damage effects have been added to both HE_nextgen ammunitions (see paragraph 221) when used on urban terrain. Seven new effects have been added which can be turned off entirely or used individually as necessary to represent different weapon systems. Tested and explained below are the seven new parameters:

a. **Smoke_type**. This parameter specifies the type of smoke (dust) that will be produced when urban destruction occurs. A smoke type_id is inserted for this parameter, which references the applicable smoke data in the smoke file. A standard smoke cloud is automatically generated and displayed on the screen if any urban square is completely destroyed. For now, this function will not be used until applicable smoke data is available. A "-1" value will be inserted to disable this functionality.

b. **Build_dest_radius**. This parameter specifies the radius in meters for complete urban destruction, that is, any urban terrain, building squares within the defined destruction

radius will be turned into rubble terrain. Now, this function will not be used until testing concerning urban destruction and damage effects has been completed. A "-1" value will be inserted to disable this functionality.

c. **Floor_dest_radius**. This parameter specifies the radius in meters for applying damage to a single floor of a building. See Ref 36, Section 5.6.8 for a complete explanation of how damage is calculated and applied. For now, this function will not be used until testing concerning urban damage effects has been completed. A " –1" value will be inserted to disable this functionality.

d. **HE_power**. This parameter specifies how destructive the round will be to the given building floor. Data for this parameter could not be located, so until reliable data is available and testing is undertaken, this parameter will not be used. A "-1" value will be inserted to disable this functionality.

e. **Near_build_kill_prob**. This parameter specifies the probability of a unit being killed inside a non-urban square, which becomes rubble. Probability values for this functionality could not be located. Until reliable data is available and has been tested a 0.0 value, which will disable this functionality, will be inserted.

f. **Floor_kill_prob**. This parameter specifies the probability of a unit being killed inside the specified floor destruction radius. Probability values for this functionality could not be located. Until reliable data is available and has been tested a 0.0 value, which will disable this functionality, will be inserted.

g. **In_build_kill_prob.** This parameter specifies the probability of a unit being killed inside the complete destruction radius. Normally a probability value of 1.0 will be used. Until the other six functionalities have been tested and this one as well, a 0.0 value, which will disable this functionality, will be inserted.

220. **Weapon-Ammunition Combinations**. Some units, especially RED APCs such as the BMP3, have several weapons firing a wide range of ammunition. In some instances, all possible weapon ammunition combinations have not been included to avoid unnecessary complications. See Chapter Two, Unit Descriptions and Assumptions that list the weapons that have been selected for each unit and the ammunition types allocated.

221. **Special Ammunition_urban Terrain.** In order to represent certain ammunition effects, particularly when fired at buildings, two special types of ammunition have been developed for Version 8.1. These two new munitions are called NEXTGEN ammunition and LARGE_HE_DAMAGE ammunition. Each is briefly described below:

a. **NEXTGEN ammunition.**

i. The NEXTGEN ammunition type uses exactly the same data fields as a conventional HE round but is treated differently by the simulation code. A conventional HE round fires directly to the aimed point, ignoring any terrain in the way although it is delayed by the appropriate time of flight. Where the shell lands in relation to its aimed position is modified by various ballistic error components contained in the weapon files. In this way, indirect fire is represented.

ii. The HE_nextgen ammunition however, makes use of the simulation bullet trajectory model calculations. Instead of using the bullet aiming and ballistic error components, it applies the standard artillery model ballistic error components. This allows the round fired to impact on the terrain before reaching the location of the aim zone. The time of flight is then determined to this point and the HE effect occurs as normal. This allows the round to hit the side of a building above or below a window and explode on contact or hit the terrain. If the round is also set as "air burst", it will explode at the aimed point, even without an impact.

iii. The data format (structure) for HE_ROUND and HE_NEXTGEN weapon and ammunition files is identical. Within the data format, the only data fields that are different are the AMMO_TYPE fields in both files, which causes some fields, which are defined in both data formats but which may not be used depending on the type of round fired, to be activated (used). For example, the BLDG_PENETRATION and BLDG_DAMAGE parameters will be used by HE_NEXTGEN ammunition while they are not by conventional HE ammunition. In order for HE_NEXTGEN ammunition to fire, there must also be HE_NEXTGEN indirect and direct fire activities defined, which contain specific decision tests and target selection rules relevant to NEXTGEN munitions. In order to fire at or into a building using

the main armament of a vehicle, a HE_NEXTGEN suppressive fire activity must be used because even though an aim zone has been placed over the building wall, the wall is not really a direct fire target in the same sense as infantry, tanks or APCs. In essence, the NEXTGEN ammunition is firing into a suppression area that happens to contain a wall, which when hit will detonate an HE_NEXTGEN round.

iv. There is no requirement to define NEXTGEN ammunition for bullet firing small arms.

v. Depending on scenario requirements HE_NEXTGEN ammunition may need to be included for indirect fire weapons, vehicle main guns and possibly, some man portable anti-armour systems.

b. **LARGE_HE_DAMAGE Ammunition.** LARGE_HE_DAMAGE ammunition is a new type of ammunition that permits large-scale damage to buildings. The data format (structure) is the same as for a conventional HE round. The difference within the two data files are as follows:

i.	BLD_PENETRATION	value is set to 0
ii.	BLD_DAMAGE	value is set to 0
iii.	LARG_PROJ	text response is set to TRUE
iv.	AIR_BURST_SHOT	text response is set to TRUE
v.	SMOKE_TYPE	insert applicable smoke type_id value
vi.	BUILD_DEST_RADIUS	insert appropriate numerical value in meters which will cause the type of damage required
vii.	Floor_dest_radius	as for vi above
viii.	HE_power	insert –1 which disables this parameter
ix.	Near_build_kill_prob	value is set to 0.0
x.	Floor_kill_prob	value is set to 0.0
xi.	In_Build_kill_prob	insert appropriate numerical kill probability

222. **SSKP file.** The SSKP file holds the single shot kill probability (SSKP) data for armour piercing (AP) ammunition against vehicle targets such as tanks and APCs. Depending upon the number of different AP ammunition types against different target type pairs defined, this file can contain huge amounts of data. Figure 24 illustrates the format of the SSKP file.

```
number_of_targets   4
number_of_covers    3
number_of_rel_motions 1
target_type_id   3   r_t72
   number_of_ammos   5
   ammo_id   56   B_105 APFSDS
      cover_1 0.0
         rel_motion_1 static_static
            number_of_ranges 4
            range_1 100
              number_of_elevations    1
              max_elevation          0.7
               number_of_angles 5
               angle_1 -3.1416 0.950 0.950 0.950 0.950
               angle_2 -1.5708 0.950 0.950 0.950 0.950
               angle_3  0.0000 0.943 0.943 0.943 0.950
               angle_4  1.5708 0.950 0.950 0.950 0.950
               angle_5  3.1416 0.950 0.950 0.950 0.950
            range_2 500
              number_of_elevations    1
              max_elevation          0.7
               number_of_angles 5
               angle_1 -3.1416 0.949 0.949 0.949 0.949
               angle_2 -1.5708 0.949 0.949 0.949 0.949
               angle_3  0.0000 0.909 0.909 0.909 0.909
               angle_4  1.5708 0.949 0.949 0.949 0.949
               angle_5  3.1416 0.949 0.949 0.949 0.949
            range_3 1000
              number_of_elevations    1
              max_elevation          0.7
               number_of_angles 5
               angle_1 -3.1416 0.895 0.895 0.895 0.895
               angle_2 -1.5708 0.894 0.894 0.894 0.894
               angle_3  0.0000 0.777 0.777 0.777 0.895
               angle_4  1.5708 0.894 0.894 0.894 0.894
               angle_5  3.1416 0.895 0.895 0.895 0.895
            range_4 2000
              number_of_elevations    1
              max_elevation          0.7

      number_of_angles 5
      angle_1 -3.1416 0.425 0.425 0.425 0.425
      angle_2 -1.5708 0.497 0.497 0.497 0.497
      angle_3  0.0000 0.177 0.177 0.177 0.177
      angle_4  1.5708 0.497 0.497 0.497 0.497
      angle_5  3.1416 0.425 0.425 0.425 0.425
```

Figure 24: SSKP File

223. The number_of_targets parameter defines the number of distinct target types for which an SSKP will be defined. The number_of_covers defines the number of cover states for each target type. Normally, three cover states are defined, but additional ones can be added (See paragraph 228).

224. The number of relative motions is normally set to four, which defines the following firer/target motions. A smaller number of relative motions can be defined but this is not advisable.

a. Static – Static

b. Moving – Static

c. Static – Moving

d. Moving – Moving

225. Each target type must have its own block of SSKP data defined for each ammunition type that will be fired at that target type. For each SSKP data block, the first line must be of the format " target_type_id 3 (T72 target)"

226. The target_type_id number is used in conjunction with the target_type_id specified in the unit data file. Thus in the T-72 unit data file, the value of 3 is input in the "target_type_id" parameter of that unit file. This allows the model to associate the block SSKP data with a T-72 unit. The advantage of using target type identifiers is that a number of vehicles may be present in the database which are distinctly different in some aspects, e.g. ammunition allocation or sensors, but are identical as targets.

227. Following this is a line, which enables the user to define the number of ammunition types that can be fired at the target_id defined in the line above. Once the number_of_ammos has been defined then the SSKP data set for each ammunition is defined by referencing each specific ammo_id, e.g. ammo_id 56 (B-105 APFSDS).

228. For each ammo_id type a number of cover states is defined. A cover is a vehicle height in meters, which corresponds to the amount of cover (usually ground or vegetation) in front of the target vehicle. For instance, a value of 0.0 means that there is no cover and the target is fully

exposed, while a value of 1.5 means that the bottom 1.5 m of the target is obscured. Setting the cover value to the height of the target type will cause the target to be completely obscured. The model code calculates the amount of cover afforded to the target, given its position on the terrain and the elevation of the firer to determine which cover state is to be used. For instance, if a target has a cover to a depth (height) of 0.3 m from a firer and cover_1 = 0.0 and cover_2 =1.5, the cover_1 SSKP data block values will be used. In the ORD database, three cover states have been defined as follows:

a.	Cover_1	0.0	A fully exposed target
b.	Cover_2	1.55	A target in an exposure similar to hull down
c.	Cover_3	2.51	A target in an exposure similar to turret down

229. For each cover state, the SSKP values are tabulated for each relative motion of the four previously listed within a number of user definable ranges with the maximum range usually corresponding to the maximum effective range of the weapon. Normally four ranges are usually defined. Within each range, a number of angles define the aspect angle between firer and target. A minimum of three aspect angles is required up to a maximum defined by the user. Normally five aspect angles are sufficient for most studies. An angle of 0.000 represents a shot at the front of the vehicle. Negative angles represent impact on the left flank of the target as viewed by the driver of the target. All angles are in radians. (See Data Users Guide p. 26).

230. An additional dimension has been added to the SSKP file in version 8.1that allows different data to be used when the firer is in elevated position. This new addition is inserted below each of the "range numbers" parameter (range bands in the data file. The addition defines "elevation bands" within each range band. The numbers and angles of elevation bands are defined in the same manner that range bands are set. Until more information is available, only one elevation with a maximum elevation of 0.7 will be defined in the ORD database, as illustrated in Figure 24. The methodology for which the code treats the information concerning the relative motion of the fire –target pair has also been modified. The simulation code now records the firer's motion at time of firing of an AP round and the target's motion at time of impact. This replaces the previous methodology in which the motion case for both parties was assessed at time of impact.

231. Finally, the SSKP values for a target in a specific cover, in a specific relative motion and within a specific range and viewed at a specific target/firer angle are listed in four columns as follows:

a. Column 1 m or mobility kill

b. Column 2 f or firepower kill

c. Column 3 mf or mobility and firepower kill

d. Column 4 k or catastrophic kill

232. Data for m, f and mf type kills is not readily available and ORD has done some work to develop a methodology for calculating these types of data. The search continues to locate appropriate values. Until appropriate data is available all data fields have been populated with the k kill data for that angle.

FLASH DETECTION FILES

233. A review of the CAEn Functional Specification, Section 6.2, paragraph two states "Each weapon/sensor combination has a flash detection probability profile associated with it." This implies that there must be a flash detection profile data block for every weapon/sensor type combination.

234. The CAEn Data Users Handbook, Section 2.2.5, Flash Detection File, p 28 indicates two things:

a. It is not necessary to have flash detection data sets for all weapon/sensor combinations.

b. In the data set format the number_of_weapons parameter is defined as "the number of data blocks expected in the rest of the file".

235. Thus, there appears to be two different approaches concerning what is required in the Flash Detection File, that is, a data set for every weapon/sensor combination or a data set for only specific weapons/sensor combinations. The convention followed for the ORD CAEn database will be that flash detection data sets have been defined only for specific weapon/sensor type combinations.

236. **Sensor Categories**. A review of two sets of British CAEn functional data indicated that five sensor categories have been defined in relation to the sensors Flash Detection IDs. The CAEn Data User's Guide does not provide any guidance on how many sensor types can be defined, so keeping in line with the British functional data, the five British sensor categories have been used. The British have been asked if more than five categories are permissible, but to date this has yet to be clarified.

237. The five sensor types have been classified as in Table II. Note that the numerical identifiers in the table below appear in both the Flash Detection Files and the Sensor Data Files. It appears that the phrases "sensor type identifier" and "flash detection ID" are corresponding terms in the Sensor Data Files and Flash Detection Files.

TABLE II
SENSOR TYPES AND FLASH IDENTIFIER

SENSOR TYPES	**FLASH ID/ SENSOR ID**
Eyeball, vision blocks, other unitary sensors	1.
Optical sensors with x2 magnification up to x7 magnification, including all II sensors	2.
Optical sensors with x8 magnification up to x9	3
Optical sensors x10 and larger magnification	4
All thermal imaging sensors	5.

238. Note also that the CAEn Data Users Guide, p 30 states that there are only three types of sensors in the database: optical sight, TI scanning, or II sight. There would appear to be different meanings for the phrases "types of sensors" and "sensor types" in various sections of the reference manuals. It has been assumed that the phrase sensor type in the Flash Detection File does NOT relate to the types of sensors defined on p 30 of the Data Users Guide. Sensor type in the Flash Detection File of this database contains various classifications of sensors and defines a numerical flash identifier for each classification.

239. **Flash ID Data Set Values**. No reference sources for flash detection ranges could be located. Therefore, the values in the various flash detection data sets reflect best guess estimates based on military judgement and experience of the military officers and Senior NCOs of ORD. The data was

reviewed and revised several times until consensus was reached. These data were then compared to British CAEn functional data and although several variations in data were noted it was felt the data was useable until more reliable data could be obtained. Several factors were considered in choosing values. Some of the more important factors were calibre of the weapon, tactical employment of the weapon, inclusion of flash suppression devices on the weapon, size and shape of weapon back blast area, quality of ammunition, propellant of the manufacturer etc.

240. A flash detection by a unit occurs if the flash of the firing weapon is within the observing unit's field of view (FOV), line of sight (LOS) is present between observer and firing weapon and a probabilistic range test based on data contained in the Flash Detection files is passed.

NOTES TO SENSOR DATA FILES

241. Sensor data has been very difficult to locate. The primary source reference is Reference 14, Jane's Electro-Optic Systems 1996-97, but even this reference is very limited. Accordingly, surrogate and best guess estimates have been used reluctantly for some parameters. When a surrogate has been used the closest RED or BLUE sensor similar in size, technical characteristics, etc. has been selected. The individual sensor notes indicate which parameters have been surrogated or "guesstimated." The data search continues and this is one section of the overall database in which the confidence level can be considered low and in need of constant updating. See Annex E for CAEn sensor index listing and Annex F for examples of sensor data files.

242. **Sensors.** Note that when assigning sensors in unit data files that the sensors assigned in these files define only "free-standing sensors," which are sensors that are not connected to a weapon. Examples of these are eyeballs, binoculars and vehicle vision blocks. Weapons also have sensors and these are generally the weapon sights, that is to say optical, image intensification, or thermal types. Sights can also have wide and narrow fields of view. Note that units may have more than one sensor but that a weapon can only have one sensor even though it may actually have multiple sensors. Care must be taken to choose the most appropriate weapon sensor based on study requirements (See Data Users Guide p13 and p 20).

243. **Sensor_generic_file.** Links the Sensor Data file with the Sensor Index by inserting the name of the sensor, as it appears in the Sensor Index.

244. **Sensor-type.** There are only three types of sensors in the database: optical sight, TI scanning, or II sight.

245. **Sensor usage.** This parameter only appears in the data file format for optical sights. There are two types of usage: monocular and binocular. Note that an "eyeball sensor" is binocular while most rifle sights are monocular.

246. **Sensor_transferable.** This parameter is not currently used but a text response of FALSE is inserted.

247. **Sensor_Max_Speed.** This parameter defines the maximum speed that the unit can be moving and still use a specific sensor. For instance, if a unit is moving at a speed less than the Sensor Max Speed, then that sensor will be available for use. For units moving at speeds greater than the Sensor Max Speed, that sensor will not be available. Typically this is to prevent units from using static sights, whilst moving. Note that units should be equipped with at least one high-speed sensor. ORD Sensor maximum speeds have been developed using the guidance contained in paragraph 5 of Ref 19.

248. **Sensor_Max_Distance.** Each sensor in versions 5.1 and 8.1 now has a maximum useable distance. This prevents processing time being wasted on futile very long-range acquisitions. Values entered in the ORD CAEn database have been derived from similar parameter values in the Janus Database.

249. **Sensor_Value**. This parameter is not currently used but a 0.0 value is entered.

250. **Flash_Det_ID**. The flash_det_id corresponds to the sensor types defined in the weapon flash detection data file. The value entered is the same as the one for the sensor type ID in the Flash Detection Files. British categories for the five sensor Flash Detection IDs have been used:

a.	Flash detection ID 1	Optics such as eyeballs, vision blocks etc.
b.	Flash detection ID 2	Low magnification optical periscopes, telescopes, sights etc. up to X7 magnification and all II sensors.
c.	Flash detection ID 3	Optical sensors from X8 to X9 magnification.
d.	Flash detection ID 4	Optical sensors X10 and larger magnification.
e.	Flash detection ID 5	All TI sensors / sights.

251. **Number_of_setting and Setting_1_data.** Neither of these parameters is used but values of 1.0 are inserted for each.

252. **Sensor-fkill.** All sensors data files in Version 8.1 must now include this additional parameter, which is inserted below the "setting_1_data" line of the data file. (See Annex F). This parameter requires a TRUE/FALSE response. If a vehicle is f-Killed (firepower kill) then it may also mean that the sight attached to the armament is also disabled. A TRUE entry means that when a unit with this sensor has been f-killed the sensor attached to the armament is no longer operational. Generally, for vehicles, which have a heavily armoured turret, such as main battle tanks, a FALSE response has been entered while for vehicles such as APCs and Recce vehicles which have lightly armoured turrets a TRUE response has been entered.

253. **Sensor_FOV_az and Sensor_FOV_el.** The field of view of the sensor in azimuth is given in radians. The field of view in elevation is not currently used but a value must be inserted. Usually, the value for field of view azimuth is inserted.

254. **Sensor_Transmission**. The sensor transmission value is a fraction and must lie between 0 and 1. A value of 1 defines perfect transmission through the sensor optics whilst 0 defines a totally opaque sensor. The value is assumed to represent transmission of electromagnetic radiation at the operational level. No data sources could be located. Values assigned have been based on a review of available British data.

255. **Surv_Weighting**. The System Data Users Guide defines this parameter as "the probability of choosing any available unit or weapon sensor to conduct a surveillance activity." See the Data Users Guide for an explanation of how this is computed. However it is not merely a question of establishing probabilities to determine sensor surveillance weightings. It is more complex. Note that the values assigned to surveillance weighting are only used during the surveillance process. It is also very much a process of determining a balance of surveillance weightings for all sensors available to a unit and matching the weighting to what the main task of the unit will be for the majority of the scenario. This process is a "HIT AND MISS" proposition at best. Establishing the balance of weightings is probably best determined during scenario test runs. Generally it stands to reason that "eyeballs" will be used the majority of the time but in any scenario the usage of a unit's other sensors, such as binoculars or a weapon sight, may be for certain periods of the scenario more predominant than the unit's use of "eyeball." The British have indicated that the weighting of additional sensors, which are not "eyeball" tend to be higher than real life values to ensure that the desired effect is achieved and needs to be considered in concert with the sensor usage times.

256. Obviously this parameter should be reviewed and surveillance weighting values adjusted on an individual scenario basis. The values currently in the database take into consideration, in a very broad sense, usage in offensive and defensive operations both in day and night. The British have suggested that surveillance weighting values should be examined for each study and adjusted accordingly based on whether it is day or night, in the case of a sensor mix study. The values should also be examined and adjusted where necessary to account for different usage rates in offensive and defensive operations.

257. **Surv_Use_Time**. This is the minimum time that the sensor will be used for surveillance once chosen. No specific data could be located. Values determined are based on military judgement, which was compared with British data where that was available.

258. **TA_Priority_Veh**. This parameter defines the priority of a sensor being used for target acquisition of a vehicle target when vehicle and infantry targets could be acquired. Values are usually higher for better sights. Units will likely use the best sight available.

259. **TA _Priority _Inf**. This parameter defines the priority of a sensor being used for target acquisition of an infantry type target when vehicle and infantry targets could be acquired. Values are usually higher for better Sights. Units will likely use the best sight available.

260. **Eye_Piece _Diameter**. Values for this parameter were obtained from references as listed for each sensor or estimated from a sensor, which was similar in nature, where specific data was not available. The value for the eyepiece diameter is given in meters.

261. **Additional TI and II Sensor Parameters**. Thermal imaging and image intensification sensors have additional parameters, which are not used by optical sensors. These parameters are discussed in the following paragraphs. Note that various values for TI and II sensors come mainly from data in the Janus Database. In particular the MTF and MRTD files have been developed from similar files in the Janus database or calculated by the Canadian research establishment located at CFB Valcartier, known as Defence Research and Development Canada - Valcartier (DRDC-Valcartier).

262. **Image Intensification Sensors.** The data format for image intensification sensors contains additional parameters that are not in the optical data sensors format. These are placed between the

sensor_type and sensor_usage parameters in the data format. The additional parameters are:

a. **Gain_tolerence.** No definition is available for this parameter. The British have been requested to provide information concerning this parameter. See also paragraph 6 of Ref 19.

b. **Sensor_MTF_file.** See pp 32-33 of the Data User's Guide.

c. **MTF_contrast_level.** See pp 32-33 of the Data User's Guide.

d. **Resolution level data.** See pp 32-33 of the Data User's Guide.

263. **Thermal Imaging Sensors.** The data format for thermal imaging sensors contains additional parameters that are not in the optical data sensors format. These additional parameters are placed between the sensor_type and sensor_usage parameters in the data format. The additional parameters are:

a. **Acquire_static_target.** This is a parameter, which defines whether the sensor is capable of acquiring a static target. If it can, a TRUE response is entered and if it can't a FALSE response is entered. If the "acquire-static-target" parameter is set to TRUE, as this is the case in Version 8.1, the TI-scanning sensor behaves such that it can acquire (detect) both moving and static targets. If it is set to FALSE the TI-scanning has the following characteristics:

i. The sensor will not acquire static targets
ii. The sensor will lose acquisition of targets when they stop.
iii. The sensor will not acquire targets in complex culture
iv. The sensor will lose acquisition of targets when then enter complex culture.

b. **Max_targ_td.** See pp 31-32 of the Data User's Guide.

c. **Max_mx_sp_fq.** See pp 31-32 of the Data User's Guide.

d. **Resolution level data.** See pp 31-32 of the Data User's Guide.

e. **MRTD_file.** See pp 31-32 of the Data User's Guide.

264. **Buildings Temperature and Contrasts**. The temperature differential between target and background is calculated using the temperature of the target unit and the terrain square in which it is standing. Consequently, buildings in an adjoining terrain square will not have any effect on the temperature contrast. Since the building temperature is defined by the culture type, as for any other culture, the inside can be represented as warmer than the outside thus making thermal detection less easy when the target is in a building.

265. **Ambient Temperature**. The temperature field defined in the meteorological file is only used once in the model. The thermal imaging model uses the value in the calculation of the attenuation coefficient of its temperature differentials.

NOTES TO AMMUNITION DATA FILES

AMMUNITION INDEX FILE

266. The ammunition index file is of similar format to the weapon and sensor index files. It defines the name of each ammunition type and its identifier number. It also defines the name of the ammunition data file where the ammunition parameters are defined. Some munitions types may reference the same ammunition data file because the data required is identical. Therefore, sharing a common data file is possible, as illustrated below:

```
60mm_Mortar_Flare    cansammo:Flare.dat
81mm_Mortar_Flare    cansammo:Flare.dat
```

Figure 25: Shared Ammo Data File

267. The ammunition index file has been organized as follows. Indirect fire ammunition for mortars is listed first, followed by howitzer ammunition. Each is listed in ascending calibre size according to type of ammunition. Indirect fire ammunition is then followed by rifle and machine gun ammunition listed in ascending calibre size. High-explosive ammunition, which is fired from grenade launchers or main guns, is then listed by ascending calibre size. Hand thrown fragmentation and smoke grenades are then listed. These are followed by armour piercing warhead ammunition fired from the main armament on tanks and APCs. Shoulder controlled/fired anti-armour (AA) weapons with HEAT ammunition are listed next. Various types of ATGMs are the last major category of ammunition. Tripflares and claymores complete the list of ammunition in the index.

268. Additional ammunition can be added to the index as required. For now, 75 types of ammunitions are defined in the CAEn database (See Annex G). The specific type of ammunition fired by each weapon is listed in Chapter II: Unit Descriptions and Assumptions.

AMMUNITION DATA FILES

269. The CAEn Version 8.1 ammunition data file format was reviewed and compared with the format used in Version 3. The review revealed that several parameters have been added as listed

below. See Annex H for an example of an ammunition data file.

a. **Ammo_type.** This parameter defines the type of ammunition, as either bullets AP_warhead, HE_warhead, smoke warhead or flare_warhead.

b. **Ammo transferable.** This parameter is not used, but a TRUE or FALSE response is required so the file will function correctly.

c. **Possesion_prob.** A parameter that is used by the civilian database and not the military database. A value is required and a value of "1.0" will be used in all ammunition data files in the ORD CAEn database.

d. **Ammo_disarm_mode.** A parameter used by the civilian database and which is not used in the military database. A text response is required. For the ORD CAEn database the text response to be used will be **"on_disarm_disable."**

e. **Ammo_infantry_Kill.** This parameter is used to tell the weapon/ammunition selection model whether it is worthwhile or useful firing an ammunition type against infantry. In general, this parameter should be set to TRUE for bullet and HE_warhead and to FALSE for AP_warhead, smoke_warhead and flare_warhead.

f. **Ammo_optical_los.** This parameter is used to define whether the ammunition can be fired in an indirect fire capacity. Note that this is possible for some weapons, which fire bullets, such as machine guns, even though the firer cannot actually see the aim point. This is possible for bullets too, which are usually line of sights, because CAEn models the actual trajectory over objects in the terrain. High trajectory ammunition fired from mortars and artillery (HE, smoke or flares) should have this parameter set to FALSE. In cases such as AP or HE rounds being fired in essentially a direct fire (line of sight to target essential) mode, then the parameter should be set to TRUE. See p. 35 of the Data Users Guide.

g. **Ammo_soft_los and _hard_los.** These are redundant elements of data, which still appear in the data file. A TRUE or FALSE response can be entered for these parameters.

h. **Ammo-kill-all-floors**. All ammunition data files must now include the new parameter, which is inserted after the ammo-hard-los line in each data file. The part of the HE code, which calculates whether the explosion of a round will result in casualties, has been altered in Version 8 to limit casualties and suppressive effects to the area within the line of sight. This allows munitions which explode to kill units only on a single floor as well as preventing units hidden behind walls from becoming casualties. This limitation can be removed by use of the new "ammo-kill-all-floors" parameter in the appropriate ammo file. This parameter controls whether an ammunition type is capable of affecting a unit out of the LOS of the explosion position. A TRUE/FALSE response is required and for most types of ammunition a FALSE response is entered. Until additional testing of this parameter in relation to the strengths of building walls is completed, it has been decided to set this parameter as FALSE except for NEXTGEN tank main gun rounds, Carl Gustav, Eryx and RPG16 rounds which will be set to TRUE.

i. **Number_armoured_targets.** This parameter is only used for AP_warhead type ammunition. The number of targets any specific AP_warhead can be fired at is defined and then each target is listed by unit and name. For all other ammunition types, this parameter is set to 0. Note that once a target is included in the list, a SSKP file for that ammunition target pairing must be created.

j. **Immunity_id.** This is a parameter used by the civilian database and which is not used by the military database. Nevertheless a value is required. For this database a value of "1" will be used in all ammunition data files.

k. **Oxygen_provision.** This is a parameter used by the civilian database and which is not used by the military database. Nevertheless, a value is required. For the current version of this database a value of "0" will be used in all ammunition data files.

l. **Allowed_unit_subsets.** This is a parameter used by the civilian database and which is not used by the military database. Nevertheless, a value is required. For the current version of this database, a value of "0" will be used in all ammunition data files.

270. A parameter called SKIRMISH is now included after the "number-armoured-targets" parameter for all ammunition types. A review of British ammunition data files indicates that a text response of FALSE is entered after the SKIRMISH parameter in all ammunition data files except for RED and BLUE hand grenade and small arms bullets type ammunition data files which have a TRUE entry. By setting the parameter to TRUE the Skirmish module is able to use that type of ammunition. This convention has been followed for the SKIRMISH parameter in this database.

271. For FLARE_WARHEAD ammunition types a parameter called POINT_FLARE is inserted after AMMO_TYPE. The point flare parameter appears to make a distinction between unmoveable ground trip flares and airburst flares fired from hand held projectors or indirect fire systems. An entry of TRUE has been inserted for trip flares and FALSE for airburst flares pending further explanation.

272. No distinction has been made for ammunition of any type fired from smooth or rifled bore 120 mm mortar tubes be they vehicle or ground mounted.

273. **Ammunition Dumps**. Ammunition dumps can be included in both CAEn military and civilian databases, although they were developed primarily for use with the civilian database. Ammunition dumps can contain weapons and ammunition (by type –e.g. bullets, or AP ammunition, HE ammunition etc.). Figure 26 below is an example of an ammo-dump index.

```
Number_of_types      3
 1              bullet_5.56      CDAammo_dump:556bullet.dat
 2              bullet_7.62      CDAammo_dump:762bullet.dat
 3              Carl Gustav AP   CDAammo_dump:CGAP.dat
```

Figure 26: Ammo Dump Index

274. An ammo dump definition contains a list of weapons and ammunitions found in that ammo-dump. Figure 27 below is an example of an ammunition dump.

275. Ammo dumps are deployed as terrain attributes in the same manner as minefields and wire. Ammo dumps function as follows. When a unit enters a terrain square containing an ammunition dump it must first detect the dump. It does this by conducting a probability of detection assessment against the detection probability defined in the ammo-dump file. If the test is successful and the

ammo-dump is detected, it then assesses which weapon and ammunition it will pick up. Any weapon or ammunition that is made available through an ammo_dump must have weapon_transferable or ammo_transferable in the weapon or ammunition file set to TRUE. Setting these values to TRUE works for the ammo_dump function but other CAEn functions may be affected as well in an undesirable manner. Caution is advised when deciding to implement the ammo_dump function. If the unit decides to pick up a weapon or ammunition it is added to their weapon/ammunition test. See Ref 39.

```
Ammo_Dump : 5.56 bullet

Density                    0.05
Detection_probability      0.05

number_of_weapons          1
_1_weapon_id               8  (C7 rifle)
_1_ammo_id                 31 (5.56mm bullet)
_1_num_loaded_rounds       0

number_of_ammos            1
_1_ammo_id                 31
_1_num_unloaded_rounds     2000
```

Figure 27: Ammo Dump Data Block

276. To date, studies which have utilized CAEn, have not required the use of ammunition dumps. ORD will develop and test ammunition dumps in the development/test database and once tested will include ammunition dumps in project databases as required.

NOTES TO HELICOPTERS

277. Although CAEn version 8.1 includes helicopters, ORD has decided for the time being not to include them in the military study/project database. However, testing on helicopters has commenced and helicopter data files have been included in the CAEn development/testing database.

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ANNEX A
RN 2003/03
MAY 2003

TABLE A-I
CAEn UNIT INDEX LISTING

Number – of - Units: 64

Unit ID	Unit Name
1	B_60mortar
2.	B_81 mortar
3	B_120 mortar
4.	B_LG1_How
5.	B_105C3_How
6.	B_105 M1A1_How
7.	B_M109 A3/4_How
8	B_Comd
9.	B_Rifmn
10.	B_Rifmn_M72
11.	B_C9_Gnr
12.	B_Grendr
13.	B_Eryx_Gnr
14	B_C6 Gnr
15.	B_Sniper
16	B_HMG_Gnr
17.	B_CARLG_Gnr
18.	B_FOO/MFC
19	B_RECCE/DET
20.	B_Recce_OBS
21.	B_LEOC1
22.	B_LEOC2
23.	B_COUGAR
24.	B_GRIZZLY
25.	B_BISON
26	B_NAPC
27.	B_COYOTE
28	B_M113A3
29.	B_TUA
30.	R_82 mortar
31.	R_120 mortar
32.	R_2S1
33.	R_2S3
34.	R_2S9
35.	R_2S23
36.	R_Comd
37.	R_Rifmn
38.	R_RPK74_Gnr

Unit ID	Unit Name
39.	R_Grendr
40.	R_RPG16_Gnr
41.	R_Rifmn_R18
42.	R_PKM_Gnr
43.	R_Sniper
44	R_HMG_Gnr
45.	R_AGS17_Gnr
46.	R_AT4_Gnr
47.	R_AT5_Gnr
48.	R_AT7_Gnr
49.	R_AT14_Gnr
50	R_RECCE_DET
51.	R_MORCOP
52.	R_T_72_ERA
53.	R_T_72
54	R_T80U
55.	R_BTR70
56	R_BTR80
57.	R_BRDM2
58	R_BMP1
59.	R_BMP2
60	R_BMP2_ERA
61.	R_BMP3
62	B_Claymore
63.	B_Tripflare
64.	R_Tripflare

ANNEX B
RN 2003/03
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EXAMPLE OF AN INFANTRY DATA FILE

```
Unit_generic_file     B_COMD
temperature           16.3

entity_speed_lookup   units:entity_speed_lookup_null.dat

inf_speed_type    stopped     slow      walk      run
infantry_speed      0.0       0.8       1.9       3.0

gradient_deg          0       2       4       6       10      20      30      37
x_country_speed       1.00    0.95    0.90    0.85    0.70    0.50    0.40    0.35
road_speed            1.00    0.98    0.93    0.88    0.75    0.55    0.45    0.40

terrain_type    water
terrain_speed   0.6
terrain_type      urban_1  urban_2  urban_3  urban_4  urban_5  urban_6
urban_7   urban_8   urban_9   urban_10
terrain_speed     0.75     0.00     0.00     0.00     0.00     0.00     0.00
    0.00      0.00      0.75
terrain_type  urban_11 urban_12 urban_13 urban_14 urban_15 urban_16 urban_17
urban_18 urban_19 urban_20
terrain_speed 0.00     0.00     0.00     0.00     0.00     0.00     0.00
0.00     0.00     0.00
terrain_type  urban_21 urban_22 urban_23 urban_24 urban_25 urban_26 urban_27
urban_28 urban_29 urban_30
terrain_speed 0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0
terrain_type  urban_31 urban_32 urban_33 urban_34 urban_35 urban_36 urban_37
urban_38 urban_39 urban_40
terrain_speed 0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0
terrain_type  urban_41 urban_42 urban_43 urban_44 urban_45 urban_46 urban_47
urban_48 urban_49 urban_50
terrain_speed 0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0
terrain_type  urban_51 urban_52 urban_53 urban_54 urban_55
terrain_speed 0.0      0.0      0.0      0.0      0.0
terrain_type       veg_1    veg_2    veg_3    veg_4    veg_5    veg_6    veg_7
  veg_8   veg_9    veg_10
terrain_speed      0.90     0.70     0.77     0.77     0.60     0.60     0.80
   0.80    0.80     0.85
terrain_type  veg_11 veg_12 veg_13 veg_14 veg_15 veg_16
terrain_speed 0970   0.65   0.70   0.95   0.70   0.75
terrain_type      cmplx_1  cmplx_2  cmplx_3  cmplx_4  cmplx_5  cmplx_6
cmplx_7  cmplx_8  cmplx_9   cmplx_10
terrain_speed     0.70     0.95     0.75     0.95     0.95     0.95     0.95
   0.95     0.75      0.75
terrain_type  cmplx_11 cmplx_12 cmplx_13 cmplx_14 cmplx_15 cmplx_16 cmplx_17
cmplx_18 cmplx_19 cmplx_20
terrain_speed 0.65     0.70     0.95     0.70     0.65     0.70     0.75
0.95     0.95     0.80
```

```
terrain_type  cmplx_21 cmplx_22 cmplx_23 cmplx_24 cmplx_25 cmplx_26 cmplx_27
cmplx_28 cmplx_29 cmplx_30
terrain_speed 0.80     0.65     0.95     0.75     0.75     0.70     0.70
0.70     0.95     0.95

posture_state     covered   head-up crawling crouching standing
posture_speed       0.00     0.00     0.20     0.40      1.00

posture_state     covered    head-up   crawling   crouching  standing
Unit_height        0.00       0.34       0.45       1.62       1.77
Unit_width         0.00       0.47       0.93       0.51       0.51
Unit_length        0.00       0.58       1.24       0.58       0.58
Sensor_height      0.00       0.19       0.30       1.47       1.62

number_of_sensors      2
sensor_id              1        (EYEBALL)
sensor_id              3        (X7BINOS)

number_of_weapons      2
weapon_id              8        (556C7RIFLE)
ammo_id               31        (556BULLET)
num_loaded_rounds     30
weapon_id             22        (HAND)
ammo_id               42        (SMKGRENADE)
num_loaded_rounds      0

number_of_ammos        3
ammo_id               31        (556BULLET)
num_unloaded_rounds  220
ammo_id               42
num_unloaded_rounds    3        (SMKGRENADE)
ammo_id               40
num_unloaded_rounds    4        (HEGRENADE)

target_type_id         1
mine_target_type_id    1
body_armour_id         1
handcuff_id            1
immunity_id            1
fratricide_range     300.0
fratricide_prob        0.10
infer_ta_range        50.0
max_ta_time           10.0
reflectivity           0.081
Hidden_unit             FALSE
target_sel_rule        1
supp_decay_rate        0.5
max_supp_level        10.0

posture_bubble   covered   eyes_up   head_up   crawling   standing
bullet_supp_az   0.0       0.75      1.00      0.8        0.8
bullet_supp_el   0.0       0.65      0.75      1.55       1.85

illumination_threshold          0.2915
peripheral_range              100.0
ignor_illum_TA_range           30.0
thinks_itself_det_recovery_time 60.0

Number_of_priority_levels 4
```

```
top_priority        supp_fire_power
next_priority       react_to_mines
next_priority       react_to_wire
bottom_priority     fight_in_building


number_of_supp_levels    2
supp_level_1             0.0   8.0    0
supp_level_2             8.0  10.0    2

undetected_ill_act      65
detected_ill_act        65
peripheral_ill_act      110
anticipate_ill_act      65
get_up_and_run          108

number_of_wire_acts      2
wire_reaction_act        1    54    49
wire_reaction_act        2    54    49

number_of_mine_acts      2
mine_reaction_act        1    104   104
mine_reaction_act        2    104   104


weapon_sharing_act      63
pickup_weapon_act       64
fight_in_building        3

Building_avoidance     False

more_obviosness_time     2.0
generic_vulnerability    2.0
start_time_aggression docile
start_time_fear       calm
start_time_abilities  1 normal_abilities
melee_wpn_ag          more_aggressive_no_diff
melee_wpn_fr          more_afraid_no_diff
melee_wpn_prob        0.0
generic_melee_method  r_fear_ni_aggression
generic_melee_targ    melee_rnd_closest_involved
push_radius           0.25
push_strength         0.1
push_ag_effect        more_aggressive_as_strong
push_fr_effect        more_afraid_less_radius
pull_strength         0.1
pull_ag_effect        more_aggressive_as_strong
pull_fr_effect        more_afraid_as_strong
debuss_ag_effect      more_aggressive_as_quick
debuss_fr_effect      more_afraid_as_quick
```

EXAMPLE OF A TANK DATA FILE

```
Unit_generic_file     B_LEO_NG
Unit_temperature      17.0

max_gradient    0.444    ! 20 degrees
min_gradient   -0.200   !  -9 degrees

entity_type    commander    loader    driver
activity_num     0            0         0

entity_speed_lookup  units:entity_speed_lookup_null.dat

veh_speed_type     stopped    creep     convoy   full_speed
vehicle_speed        0.0       1.11       9.16       18.05

acceleration          1.0    m/s/s

gradient_deg          0       2       4       6      10      20      30      37
x_country_speed       1.00    0.95    0.85    0.75   0.60    0.30    0.11    0.05
road_speed            1.00    0.98    0.90    0.80   0.65    0.35    0.22    0.10

terrain_type        water
terrain_speed        0.90
terrain_type       urban_1  urban_2  urban_3  urban_4  urban_5  urban_6
urban_7   urban_8   urban_9    urban_10
terrain_speed      0.0       0.0       0.0       0.0       0.0       0.0       0.0
    0.0       0.0         0.0
terrain_type  urban_11 urban_12 urban_13 urban_14 urban_15 urban_16 urban_17
urban_18 urban_19 urban_20
terrain_speed 0.0       0.0       0.0       0.0       0.0       0.0       0.0
0.0       0.0       0.0
terrain_type  urban_21 urban_22 urban_23 urban_24 urban_25 urban_26 urban_27
urban_28 urban_29 urban_30
terrain_speed 0.0       0.0       0.0       0.0       0.0       0.0       0.0
0.0       0.0       0.0
terrain_type  urban_31 urban_32 urban_33 urban_34 urban_35 urban_36 urban_37
urban_38 urban_39 urban_40
terrain_speed 0.0       0.0       0.0       0.0       0.0       0.0       0.0
0.0       0.0       0.0
terrain_type  urban_41 urban_42 urban_43 urban_44 urban_45 urban_46 urban_47
urban_48 urban_49 urban_50
terrain_speed 0.0       0.0       0.0       0.0       0.0       0.0       0.0
0.0       0.0       0.0
terrain_type  urban_51 urban_52 urban_53 urban_54 urban_55
terrain_speed 0.0       0.0       0.0       0.0       0.0
terrain_type        veg_1     veg_2     veg_3     veg_4     veg_5     veg_6     veg_7
  veg_8    veg_9     veg_10
terrain_speed       1.00      0.85      0.90      0.90      0.75      0.75      1.00
   1.00     1.00      1.00
terrain_type  veg_11 veg_12 veg_13 veg_14 veg_15 veg_16
terrain_speed 1.00    0.80    0.85    1.00    0.85    0.87
terrain_type       cmplx_1   cmplx_2   cmplx_3   cmplx_4   cmplx_5   cmplx_6
cmplx_7   cmplx_8   cmplx_9    cmplx_10
terrain_speed      0.50      0.45      0.45      0.50      0.50      0.50      0.45
   0.45      0.45       0.45
terrain_type  cmplx_11 cmplx_12 cmplx_13 cmplx_14 cmplx_15 cmplx_16 cmplx_17
cmplx_18 cmplx_19 cmplx_20
```

```
terrain_speed 0.35     0.60     0.55     0.45     0.45     0.45     0.35
0.95     0.45     0.50
terrain_type  cmplx_21 cmplx_22 cmplx_23 cmplx_24 cmplx_25 cmplx_26 cmplx_27
cmplx_28 cmplx_29 cmplx_30
terrain_speed 0.55     0.55     0.60     0.55     0.55     0.55     0.80
0.80     0.95     0.95

cover_state     fully_exp fully_exp fully_exp fully_exp fully_exp
Unit_height      2.62      2.62      2.62      2.62      2.62
Unit_width       3.37      3.37      3.37      3.37      3.37
Unit_length      7.09      7.09      7.09      7.09      7.09
Sensor_height    2.59      2.59      2.59      2.59      2.59

number_of_sensors      3
sensor_id              1       gunner    FALSE    FALSE      <- (EYEBALL)
sensor_id              4       gunner    TRUE     FALSE      <- (VISIONBLOCK)
sensor_id             17       gunner    FALSE    FALSE      <- (X14 LEO)
SIGHT)

Turret_rotation       0.261

number_of_weapons      3
weapon_id             17        <- 105MAINGUN
ammo_id               56        <- 105APFSDS
num_loaded_rounds      1
weapon_id             12        <- B 762 COAX
ammo_id               32
num_loaded_rounds    105
weapon_id             22        <- B HAND
ammo_id               42
num_loaded_rounds      8

number_of_ammos        5
ammo_id               56        <- 105APFSDS
num_unloaded_rounds   38
ammo_id               55        <- 105HESH
num_unloaded_rounds    1
ammo_id               74        <- B 105 HE NEXTGEN
num_unloaded_rounds    8
ammo_id               32        <- B 762 BULLET
num_unloaded_rounds  895
ammo_id               42        <- SMOKE GRENADE
num_unloaded_rounds    8

target_type_id         3
mine_target_type_id    1
armour_id              3
fraticide_range      300.0
fraticide_prob         0.1
infer_ta_range        50.0
max_ta_time           10.0
reflectivity           0.105
Hidden_unit           FALSE
run_over_capability   TRUE
target_sel_rule        1
supp_decay_rate        0.0
max_supp_level         0.0

posture_bubble   covered   eyes_up   head_up   crawling   standing
```

```
bullet_supp_az    0.0       0.75       1.00       0.8        0.8
bullet_supp_el    0.0       0.65       0.75       1.55       1.85

number_of_supp_levels     1
supp_level_1            0.0    0.0     0

number_of_wire_acts       1
wire_reaction_act         1      94 94

number_of_mine_acts       2
mine_reaction_act         1      104 104
mine_reaction_act         2      104 104

weapon_sharing_act       63
pickup_weapon_act        64
fight_in_building         3

Building_avoidance       False

push_radius               5.0
push_strength             1000000.0
```

EXAMPLE OF AN APC DATA FILE

```
Unit_generic_file     B_M113_A3
Unit_temperature      17.0

max_gradient    0.778    ! 35 degrees
min_gradient   -0.222    ! -10 degrees

debuss_time           7.0
min_debuss_time       5.0
embus_time           10.0
max_embus_time       60.0
embuss_limit         10.0
p_kill_embussed       0.0

entity_type    commander    loader    driver
activity_num     0            0         0

entity_speed_lookup  units:entity_speed_lookup_null.dat

veh_speed_type     stopped    creep     convoy   full_speed
vehicle_speed        0.0       1.90       9.16       18.25

acceleration          1.0    m/s/s

gradient_deg          0       2       4       6      10      20      30      37
x_country_speed       1.00    0.95    0.85    0.75   0.60    0.30    0.11    0.05
road_speed            1.00    0.98    0.90    0.80   0.65    0.35    0.22    0.10

terrain_type        water
terrain_speed        0.95
terrain_type       urban_1  urban_2  urban_3  urban_4  urban_5  urban_6
urban_7   urban_8   urban_9    urban_10
terrain_speed      0.0       0.0       0.0       0.0       0.0       0.0       0.0
    0.0       0.0         0.0
terrain_type  urban_11 urban_12 urban_13 urban_14 urban_15 urban_16 urban_17
urban_18 urban_19 urban_20
terrain_speed 0.0       0.0       0.0       0.0       0.0       0.0       0.0
0.0       0.0       0.0
terrain_type  urban_21 urban_22 urban_23 urban_24 urban_25 urban_26 urban_27
urban_28 urban_29 urban_30
terrain_speed 0.0       0.0       0.0       0.0       0.0       0.0       0.0
0.0       0.0       0.0
terrain_type  urban_31 urban_32 urban_33 urban_34 urban_35 urban_36 urban_37
urban_38 urban_39 urban_40
terrain_speed 0.0       0.0       0.0       0.0       0.0       0.0       0.0
0.0       0.0       0.0
terrain_type  urban_41 urban_42 urban_43 urban_44 urban_45 urban_46 urban_47
urban_48 urban_49 urban_50
terrain_speed 0.0       0.0       0.0       0.0       0.0       0.0       0.0
0.0       0.0       0.0
terrain_type  urban_51 urban_52 urban_53 urban_54 urban_55
terrain_speed 0.0       0.0       0.0       0.0       0.0
terrain_type        veg_1     veg_2     veg_3     veg_4     veg_5     veg_6     veg_7
  veg_8    veg_9     veg_10
terrain_speed       1.00      0.85      0.90      0.90      0.75      0.75      1.00
   1.00     1.00      1.00
terrain_type  veg_11 veg_12 veg_13 veg_14 veg_15 veg_16
```

```
terrain_speed 1.00   0.80   0.85   1.00   0.85   0.87
terrain_type      cmplx_1  cmplx_2  cmplx_3  cmplx_4  cmplx_5  cmplx_6
cmplx_7  cmplx_8  cmplx_9   cmplx_10
terrain_speed     0.50     0.45     0.45     0.50     0.50     0.50     0.45
    0.45    0.45      0.45
terrain_type  cmplx_11 cmplx_12 cmplx_13 cmplx_14 cmplx_15 cmplx_16 cmplx_17
cmplx_18 cmplx_19 cmplx_20
terrain_speed 0.35     0.60     0.55     0.45     0.45     0.45     0.35
0.95     0.45     0.50
terrain_type  cmplx_21 cmplx_22 cmplx_23 cmplx_24 cmplx_25 cmplx_26 cmplx_27
cmplx_28 cmplx_29 cmplx_30
terrain_speed 0.55     0.55     0.60     0.55     0.55     0.55     0.80
0.80     0.95     0.95

cover_state     fully_exp fully_exp fully_exp fully_exp fully_exp
Unit_height      2.52      2.52      2.52      2.52      2.52
Unit_width       2.68      2.68      2.68      2.68      2.68
Unit_length      5.30      5.30      5.30      5.30      5.30
Sensor_height    2.52      2.52      2.52      2.52      2.52

number_of_sensors      3
sensor_id              1   gunner     FALSE  FALSE
sensor_id              4   gunner     TRUE   FALSE
sensor_id              3   gunner     FALSE  FALSE

turret_rotation       0.157

number_of_weapons      1
weapon_id             13      <- (127HMG)
ammo_id               34      <- (127BULLET)
num_loaded_rounds     220

number_of_ammos        1
ammo_id               34      <- (127BULLET)
num_unloaded_rounds   1780

target_type_id         6
mine_target_type_id    1
armour_id              3
handcuff_id            1
immunity_id            1
fraticide_range      300.0
fraticide_prob         0.10
infer_ta_range        50.0
max_ta_time           10.0
reflectivity           0.105
Hidden_unit            FALSE
run_over_capability    TRUE
target_sel_rule          1
supp_decay_rate        0.0
max_supp_level         0.0

posture_bubble   covered   eyes_up   head_up   crawling   standing
bullet_supp_az   0.0       0.75      1.00      0.8        0.8
bullet_supp_el   0.0       0.65      0.75      1.55       1.85

number_of_supp_levels    1
supp_level_1           0.0   0.0    0
```

```
number_of_wire_acts      1
wire_reaction_act        1     94     94

number_of_mine_acts      2
mine_reaction_act        1     104    104
mine_reaction_act        2     104    104

weapon_sharing_act       63
pickup_weapon_act        64
fight_in_building        3

Building_avoidance       False

push_radius              5.0
push_strength            1000000.0
```

ANNEX C
RN 2003/03
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TABLE C-I
CAEn WEAPONS INDEX LISTING

Number – of - Weapons: 56

Weapon ID	Weapon Name
1	B_60 mortar
2.	B_81 mortar
3.	B_120 mortar
4.	B_LG1_How
5.	B_105C3_How
6.	B_105M1A1_How
7	B_M109A3/A4_How
8.	B_5.56C7_Rifle
9.	B_5.56C9_LMG
10.	B_7.62C6_GPMG
11	B_C3A1 Sniper_Rifle
12.	B_7.62 coax_MMG
13	B_HMG_Grnd_mount
14.	B_Grizzly_main_gun
15	B_25mm_chain_gun
16.	B_76 Cougar_main_gun
17.	B_LEO_main_gun
18.	B_M72_LAW
19	B_CARLG_MAW
20	B_ERYX_MAW
21	B_TUA_HAW
22	B_Hand
23.	B_M203_Grenade_Launcher
24.	R_82 mortar
25.	R_120 mortar
26.	R_2S1_How
27.	R_2S3_How
28	R_2S9_SP_mortar
29.	R_2S23_SP_mortar
30.	R_5.45AK74_Rifle
31.	R_5.45RPK_LMG
32.	R_Sniper_Rifle
33.	R_PKM_GPMG
34.	R_7.62 coax_MMG
35.	R_12.7_HMG
36.	R_14.5_VEH_HMG
37.	R_AGS_17
38	R_40mm_Grenade_Launcher

Weapon ID	Weapon Name
39	R_30mm_BMP2_cannon
40	R_30mm_BMP3_cannon
41	R_73mm_BMP1_cannon
42.	R_100mm_BMP3_main_gun
43.	R_125mm_tank_gun
44.	R_RPG18_LAW
45.	R_RPG16_MAW
46.	R_AT3_ATGW
47.	R_BMP1_aux_wpn
48.	R_AT4_ATGW
49	R_AT5_ATGW
50.	R_BMP2_aux_wpn
51.	R_AT7_ATGW
52.	R_AT14_ATGW
53.	R_Hand
54.	B_claymore
55.	B_trip_flare
56.	R_trip_flare

ANNEX D
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MAY 2003

EXAMPLES OF WEAPON DATA FILES

```
Weapon_generic_file    B_556_C7_RIFLE

Weapon_transferable    FALSE
Weapon_Fire_From_Building TRUE
Multi_Nature_Weapon        FALSE
Weapon_disarm_mode     on_disarm_use
Prerequisites          0
Possession_prob        1.0
Pickup_range          30.0
Aim_time_max           5.0
Aim_time_min           3.0
Max_aim_at_range       30
Min_aim_at_range       5
Sensor_id              5
Aiming_Setting_id      1
Weapon_slew_rate       0.0
Direct_fire_act_id     13
Supp_fire_act_id       16
noise_range          300.0
noise_angle            0.4

fire_speed             0.8
fire_on_move           TRUE
aim_on_move            FALSE

Number_of_ammos        1

ammo_type              bullet
ammo_type_id          31
load_capacity         30
load_time              5.0
max_range            600.0
min_range              0.0
burst_num              1

number_traj_elements      14
range      velocity      elevation     ToF      range_error  az_error
   0         935.0          0.000      0.000       0.000       0.000
  50         882.3          0.299      0.055       0.000       0.000
 100         831.1          0.628      0.114       0.000       0.000
 150         781.3          0.987      0.176       0.000       0.000
 200         732.9          1.355      0.242       0.000       0.000
 250         686.1          1.769      0.312       0.000       0.000
 300         640.7          2.221      0.388       0.000       0.000
 350         596.6          2.719      0.469       0.000       0.000
 400         554.0          3.263      0.555       0.000       0.000
 450         512.9          3.869      0.649       0.000       0.000
 500         473.5          4.546      0.751       0.000       0.000
```

```
 550          435.8          5 306        0.861        0.000        0.000
 600          399.9          6.158        0.981        0.000        0.000
 650          365.6          7.117        1.111        0.000        0.000

tol_zn_width       1.0
tol_zn_length      10.0
tol_zn_gradient    0.25
tol_zn_radius      0.0

BLD_PENETRATION    2700
BLD_DAMAGE         320
LARGE_PROJ         FALSE
AIRBURST_SHOT      FALSE

fund_err_az             0.00020
fund_err_el             0.00020
zero_err_az             0.00070
zero_err_el             0.00070
firer_err_cov_az        0.00029
firer_err_cov_el        0.00029
firer_err_eu_az         0.00029
firer_err_eu_el         0.00029
firer_err_hu_az         0.00029
firer_err_hu_el         0.00029
firer_err_cwl_az        0.00030
firer_err_cwl_el        0.00030
firer_err_fe_az         0.00029
firer_err_fe_el         0.00029
range_est_err           0.15000
lead_est_err            0.15000
wind_est_err            0.15000
snd_shot_x_err          0.0120
snd_shot_y_err          0.0150
snd_shot_x_sd           0.0100
snd_shot_y_sd           0.0100
AZIMUTH_RAPID_MULT      2.0
ELEVATION_RAPID_MULT    2.0
supp_dose               1.00  2.00
expectation_time        2.00  4.00
awareness_prob          1.00  1.00

Kill_prob               1.0
Individual_injury_data
Individual_injuries     1
Individual_injury       no_injury   1.0   -1.0    calm    docile    -1.0
```

```
Weapon_generic_file    B_60_MORTAR

Weapon_transferable    FALSE
Weapon_fire_from_building    FALSE
Multi_Nature_Weapon    False
Weapon_disarm_mode     on_disarm_use
Prerequisites          0
Possession_prob        1.0
Pickup_range           0.0
Aim_time_max           30.0
Aim_time_min           25.0
Max_aim_at_range       30
Min_aim_at_range       5
Sensor_id              2
Aiming_Setting_id      1
Weapon_slew_rate       0.0
Direct_fire_act_id     13
Supp_fire_act_id       16
noise_range            300.0
noise_angle            0.4

fire_speed             0.0
fire_on_move           FALSE
aim_on_move            FALSE

Number_of_ammos        3

ammo_type              HE_warhead        (C110 HE)
ammo_type_id           1
load_capacity          1
load_time              8.0
max_range           2150.0
min_range             70.0
burst_num              1

number_traj_elements      5
range       velocity      elevation     ToF       range_error  az_error
acc_range  acc_line  con_range  con_line
2800          350.0          0.0         32.000       45.620       14.560  41.500
    14.500     20.000      4.000
2000          320.0          0.0         26.000       35.850       14.870  33.000
    14.000     14.000      5.000
1000          280.0          0.0         16.000       29.430       12.370  29.000
    12.000      5.000      3.000
 100           60.0          0.0         16.000       10.300        4.240   9.000
     3.000      5.000      3.000
   0            0.0          0.0          0.000        0.000        0.000   0.000
     0.000      0.000      0.000

tol_zn_width           1.0
tol_zn_length          10.0
tol_zn_gradient        0.25
tol_zn_radius          0.0

BLD_PENETRATION        1391
BLD_DAMAGE             302
LARGE_PROJ             FALSE
AIRBURST_SHOT          FALSE

tank_kill_prob         1.00
tank_kill_radius       2.05
```

apc_kill_prob	1.00				
apc_kill_radius	3.35				
aim_bearing	1.5707				
Inf kill data	hiding	kneeling	crawling	crouching	standing
number_of_kill_radii	4				
Kill_prob_open	0.66	0.93	0.99	0.99	0.99
kill_prob_wood	0.62	0.94	0.99	0.99	0.99
Kill_prob_fu	0.51	0.89	0.98	0.99	0.99
Kill_prob_ufu	0.58	0.91	0.99	0.99	0.99
Kill_radius_open	1.0	1.0	1.0	1.0	1.0
Kill_radius_wood	1.0	1.0	1.0	1.0	1.0
Kill_radius_fu	1.0	1.0	1.0	1.0	1.0
Kill_radius_ufu	1.0	1.0	1.0	1.0	1.0
kill_prob_open	0.19	0.75	0.92	0.94	0.94
kill_prob_wood	0.14	0.77	0.93	0.95	0.95
kill_prob_fu	0.07	0.63	0.87	0.90	0.91
kill_prob_ufu	0.11	0.69	0.89	0.92	0.93
kill_radius_open	2.0	2.0	3.0	3.0	3.0
kill_radius_wood	2.0	2.0	3.0	3.0	3.0
kill_radius_fu	2.0	2.0	3.0	3.0	3.0
kill_radius_ufu	2.0	2.0	3.0	3.0	3.0
kill_prob_open	0.02	0.53	0.79	0.84	0.85
kill_prob_wood	0.01	0.56	0.82	0.86	0.87
kill_prob_fu	0.00	0.35	0.68	0.75	0.77
kill_prob_ufu	0.01	0.43	0.73	0.79	0.81
kill_radius_open	3.0	3.0	5.0	5.0	5.0
kill_radius_wood	3.0	3.0	5.0	5.0	5.0
kill_radius_fu	3.0	3.0	5.0	5.0	5.0
kill_radius_ufu	3.0	3.0	5.0	5.0	5.0
kill_prob_open	0.00	0.32	0.40	0.49	0.52
kill_prob_wood	0.00	0.35	0.46	0.56	0.58
kill_prob_fu	0.00	0.16	0.22	0.31	0.34
kill_prob_ufu	0.00	0.22	0.29	0.39	0.42
kill_radius_open	4.0	4.0	10.0	10.0	10.0
kill_radius_wood	4.0	4.0	10.0	10.0	10.0
kill_radius_fu	4.0	4.0	10.0	10.0	10.0
kill_radius_ufu	4.0	4.0	10.0	10.0	10.0
Inf kill data	hiding	kneeling	crawling	crouching	standing
Kill_prob_open	0.66	0.93	0.99	0.99	0.99
Kill_prob_wood	0.62	0.94	0.99	0.99	0.99
Kill_prob_fu	0.51	0.89	0.98	0.99	0.99
Kill_prob_ufu	0.58	0.91	0.99	0.99	0.99
Kill_radius_open	1.0	1.0	1.0	1.0	1.0
Kill_radius_wood	1.0	1.0	1.0	1.0	1.0
Kill_radius_fu	1.0	1.0	1.0	1.0	1.0
Kill_radius_ufu	1.0	1.0	1.0	1.0	1.0

Individual injury data						
Individual_injuries	1					
Individual_injury	no_injury	1.0	-1.0	calm	docile	-1.0
suppressive_dose	5.0 5.0					
expectation_time	4.0 4.0					
suppression_radius	10.0 10.0					
smoke_type	-1					

```
build_dest_radius       -1.0
floor_dest_radius       0.2
he_power                350
near_build_kill_prb     0.0
floor_kill_prb          0.0
in_build_kill_prb       0.0

ammo_type               Smoke_warhead
ammo_type_id            8
load_capacity           1
load_time               8.0
max_range               1465.0
min_range               91.0
burst_num               1

number_traj_elements    5
range       velocity    elevation   ToF     range_error  az_error
acc_range  acc_line  con_range  con_line
2800          350.0         0.0        32.000      45.620      14.560   41.500
    14.500     20.000     4.000
2000          320.0         0.0        26.000      35.850      14.870   33.000
    14.000     14.000     5.000
1000          280.0         0.0        16.000      29.430      12.370   29.000
    12.000      5.000     3.000
 100           60.0         0.0        16.000      10.300       4.240    9.000
     3.000      5.000     3.000
   0            0.0         0.0         0.000       0.000       0.000    0.000
     0.000      0.000     0.000

tol_zn_width            1.0
tol_zn_length           10.0
tol_zn_gradient         0.25
tol_zn_radius           0.0

BLD_PENETRATION         200
BLD_DAMAGE              10
LARGE_PROJ              FALSE
AIRBURST_SHOT           FALSE

smoke_width             50
smoke_duration          30
smoke_height            20
smoke_type              8
aim_bearing             1.5707

ammo_type               flare_warhead
ammo_type_id            13
load_capacity           1
load_time               8.0
max_range               1000.0
min_range               375.0
burst_num               1

number_traj_elements    2
range       velocity    elevation   ToF     range_error  az_error
acc_range acc_line   con_range  con_line
1000          280.0         0.0        16.000      29.430      12.370   29.000
    12.000      5.000     3.000
 100           60.0         0.0        16.000      10.300       4.240    9.000
     3.000      5.000     3.000
```

```
tol_zn_width       1.0
tol_zn_length      10.0
tol_zn_gradient    0.25
tol_zn_radius      0.0

BLD_PENETRATION     200
BLD_DAMAGE          10
LARGE_PROJ          FALSE
AIRBURST_SHOT       FALSE

luminant_power      330000
flare_duration      25
burst_height        400.0
decent_rate         5
visible_radius      300
core_radius         5
aim_bearing         1.5707
```

```
Weapon_generic_file    B_LEO_MAIN_NG_GUN

Weapon_transferable    FALSE
Weapon_fire_from_building     FALSE
Multi_Nature_Weapon           FALSE
Weapon_disarm_mode     on_disarm_use
Prerequisites          0
Possession_prob        1.0
Pickup_range           0.0
Aim_time_max           8.0
Aim_time_min           4.0
Max_aim_at_range       30
Min_aim_at_range        5
Sensor_id              17
Aiming_Setting_id      1
Weapon_slew_rate       3.0
Direct_fire_act_id     13
Supp_fire_act_id       16
noise_range          500.0
noise_angle            0.4

fire_speed             9.6
fire_on_move           TRUE
aim_on_move            TRUE

Number_of_ammos        3

ammo_type              ap_warhead
ammo_type_id          56
load_capacity          1
load_time              2.0
max_range           3500.0
min_range              0.0
burst_num              1

number_traj_elements     11
range      velocity      elevation     ToF      range_error  az_erro
   0         1485          0.00       0.00        0.000       0.000
 500         1458          1.13       0.34        0.000       0.000
1000         1432          2.30       0.69        0.000       0.000
1500         1406          3.49       1.04        0.000       0.000
2000         1380          4.70       1.40        0.000       0.000
2200         1370          5.20       1.54        0.000       0.000
2400         1360          5.70       1.69        0.000       0.000
2600         1350          6.20       1.84        0.000       0.000
2800         1341          6.71       1.99        0.000       0.000
3000         1331          7.22       2.14        0.000       0.000
3500         1311          7.50       2.50        0.000       0.000

tol_zn_width       1.0
tol_zn_length      10.0
tol_zn_gradient    0.25
tol_zn_radius      0.0

BLD_PENETRATION    200
BLD_DAMAGE         10
LARGE_PROJ         FALSE
AIRBURST_SHOT      FALSE

ammo_type              ap_warhead
ammo_type_id          55
```

```
load_capacity          1
load_time              2.0
max_range           6000.0
min_range              0.0
burst_num              1

number_traj_elements     13
range      velocity      elevation     ToF      range_error  az_error
   0         731.5         0.00        0.00        0.000       0.000
 500         675.7         1.13        0.74        0.000       0.000
1000         613.5         2.30        1.63        0.000       0.000
1500         559.7         3.49        2.68        0.000       0.000
2000         512.8         4.70        3.90        0.000       0.000
2500         472.6         5.70        5.29        0.000       0.000
3000         439.2         7.22        6.83        0.000       0.000
3500         411.3         8.42        8.51        0.000       0.000
4000         388.7         9.62       10.29        0.000       0.000
4500         369.1        10.75       12.19        0.000       0.000
5000         351.6        11.88       14.22        0.000       0.000
5500         335.8        13.03       16.38        0.000       0.000
6000         321.2        14.16       18.68        0.000       0.000

tol_zn_width       1.0
tol_zn_length      10.0
tol_zn_gradient    0.25
tol_zn_radius      0.0

BLD_PENETRATION    200
BLD_DAMAGE         10
LARGE_PROJ         FALSE
AIRBURST_SHOT      FALSE

ammo_type             HE_NEXTGEN
ammo_type_id          74
load_capacity         1
load_time             2.0
max_range          6000.0
min_range             0.0
burst_num             1

number_traj_elements     7
range      velocity      elevation     ToF      range_error  az_error
acc_range  acc_line  con_range con_line
6000         850.0          0.00        7.06        3.000       3.000       3.000
     3.000      0.000      0.000
5000         850.0          0.00        5.88        2.500       2.500       2.500
     2.500      0.000      0.000
4000         850.0          0.00        4.70        2.000       2.000       2.000
     2.000      0.000      0.000
3000         850.0          0.00        3.53        1.500       1.500       1.500
     1.500      0.000      0.000
2000         850.0          0.00        2.36        1.000       1.000       1.000
     1.000      0.000      0.000
1000         850.0          0.00        1.18        1.000       1.000       1.000
     1.000      0.000      0.000
   0           0.0          0.00        0.00        0.000       0.000       0.000
     0.000      0.000      0.000

tol_zn_width       1.0
tol_zn_length      10.0
tol_zn_gradient    0.25
```

tol_zn_radius	0.0
BLD_PENETRATION	10000
BLD_DAMAGE	1000
LARGE_PROJ	FALSE
AIRBURST_SHOT	TRUE
tank_kill_prob	0.0
tank_kill_radius	3.04
apc_kill_prob	1.0
apc_kill_radius	4.97
aim_bearing	1.5707

Inf kill data	hiding	kneeling	crawling	crouching	standing
Number_of_kill_radii	4				
Kill_prob_open	0.83	0.97	1.00	1.00	1.00
Kill_prob_wood	0.80	0.97	1.00	1.00	1.00
Kill_prob_fu	0.74	0.95	0.99	0.99	0.99
Kill_prob_ufu	0.78	0.96	0.99	1.00	1.00
Kill_radius_open	1.0	1.0	1.0	1.0	1.0
Kill_radius_wood	1.0	1.0	1.0	1.0	1.0
Kill_radius_fu	1.0	1.0	1.0	1.0	1.0
Kill_radius_ufu	1.0	1.0	1.0	1.0	1.0
Kill_prob_open	0.47	0.88	0.93	0.92	0.93
Kill_prob_wood	0.42	0.89	0.95	0.94	0.94
Kill_prob_fu	0.29	0.81	0.89	0.88	0.89
Kill_prob_ufu	0.37	0.84	0.91	0.90	0.91
Kill_radius_open	2.0	2.0	4.0	5.0	5.0
Kill_radius_wood	2.0	2.0	4.0	5.0	5.0
Kill_radius_fu	2.0	2.0	4.0	5.0	5.0
Kill_radius_ufu	2.0	2.0	4.0	5.0	5.0
Kill_prob_open	0.19	0.75	0.66	0.73	0.75
Kill_prob_wood	0.14	0.77	0.70	0.77	0.78
Kill_prob_fu	0.06	0.62	0.50	0.59	0.62
Kill_prob_ufu	0.11	0.68	0.57	0.65	0.68
Kill_radius_open	3.0	3.0	10.0	10.0	10.0
Kill_radius_wood	3.0	3.0	10.0	10.0	10.0
Kill_radius_fu	3.0	3.0	10.0	10.0	10.0
Kill_radius_ufu	3.0	3.0	10.0	10.0	10.0
Kill_prob_open	0.05	0.45	0.18	0.28	0.31
Kill_prob_wood	0.03	0.48	0.25	0.34	0.37
Kill_prob_fu	0.01	0.27	0.21	0.31	0.34
Kill_prob_ufu	0.02	0.34	0.28	0.18	0.21
Kill_radius_open	4.0	5.0	20.0	20.0	20.0
Kill_radius_wood	4.0	5.0	20.0	20.0	20.0
Kill_radius_fu	4.0	5.0	15.0	15.0	15.0
Kill_radius_ufu	4.0	5.0	15.0	20.0	20.0

Inf kill data	hiding	kneeling	crawling	crouching	standing
Kill_prob_open	0.83	0.97	1.00	1.00	1.00
Kill_prob_wood	0.80	0.97	1.00	1.00	1.00
Kill_prob_fu	0.74	0.95	0.99	0.99	0.99
Kill_prob_ufu	0.78	0.96	0.99	1.00	1.00
Kill_radius_open	1.0	1.0	1.0	1.0	1.0
Kill_radius_wood	1.0	1.0	1.0	1.0	1.0
Kill_radius_fu	1.0	1.0	1.0	1.0	1.0
Kill_radius_ufu	1.0	1.0	1.0	1.0	1.0

```
Individual injury data
Individual_injuries    1
Individual_injury      no_injury   1.0    -1.0   calm   docile   -1.0

suppressive_dose     3.0 3.0
expectation_time    10.0 10.0
suppression_radius  10.0 10.0

smoke_type           -1
build_dest_radius    -1.0
floor_dest_radius    -1.0
he_power             2000
near_build_kill_prb  0.0
floor_kill_prb       0.0
in_build_kill_prb    0.0
```

```
Weapon_generic_file    R_2S9_LARGE_HE_DAM

Weapon_transferable    FALSE
Weapon_fire_from_building    FALSE
Multi_Nature_Weapon    False
Weapon_disarm_mode     on_disarm_disable
Prerequisites          0
Possession_prob        1
Pickup_range           0.0
Aim_time_max          65.0
Aim_time_min          60.0
Max_aim_at_range      30
Min_aim_at_range       5
Sensor_id              2
Aiming_Setting_id      1
Weapon_slew_rate       3.0
Direct_fire_act_id    13
Supp_fire_act_id      16
noise_range          400.0
noise_angle            0.4

fire_speed             0.0
fire_on_move           FALSE
aim_on_move            FALSE

Number_of_ammos        1

ammo_type              HE_nextgen
ammo_type_id           6
load_capacity          1
load_time              10
max_range           7100.0
min_range            460.0
burst_num              1

number_traj_elements      6
range       velocity      elevation     ToF       range_error  az_error
acc_range acc_line  con_range  con_line
7100          300          0.000        42.000       155.500       72.100  110.000
   51.000   110.000     51.000
5500          279          0.000        36.000        87.000       40.000   69.000
   30.000     53.000     26.000
3700          210          0.000        40.000        57.630       31.110   45.000
   22.500     36.000     22.000
1800          150          0.000        36.000        29.410       15.560   24.000
   11.000     17.000     11.000
 460          120          0.000        45.000        10.810        5.660    9.000
    4.000      6.000      4.000
   0             0          0.000         0.000         0.000        0.000    0.000
    0.000      0.000      0.000

tol_zn_width           1
tol_zn_length          10
tol_zn_gradient        0.25
tol_zn_radius          0.0

BLD_PENETRATION        0
BLD_DAMAGE             0
LARGE_PROJ             TRUE
AIRBURST_SHOT          TRUE
```

```
tank_kill_prob          0.00
tank_kill_radius        0.00
apc_kill_prob           0.00
apc_kill_radius         0.00
aim_bearing             1.5707

Inf kill data          hiding    kneeling crawling crouching standing
Number_of_kill_radii     1
Kill_prob_open           0.79       0.96     0.99      1.00      1.00
Kill_prob_wood           0.76       0.96     1.00      1.00      1.00
Kill_prob_fu             0.68       0.94     0.99      0.99      0.99
Kill_prob_ufu            0.73       0.95     0.99      0.99      1.00
Kill_radius_open         1.0        1.0      1.0       1.0       1.0
Kill_radius_wood         1.0        1.0      1.0       1.0       1.0
Kill_radius_fu           1.0        1.0      1.0       1.0       1.0
Kill_radius_ufu          1.0        1.0      1.0       1.0       1.0


Inf kill data          hiding    kneeling crawling crouching standing
Kill_prob_open           0.79       0.96     0.99      1.00      1.00
Kill_prob_wood           0.76       0.96     1.00      1.00      1.00
Kill_prob_fu             0.68       0.94     0.99      0.99      0.99
Kill_prob_ufu            0.73       0.95     0.99      0.99      1.00
Kill_radius_open         1.0        1.0      1.0       1.0       1.0
Kill_radius_wood         1.0        1.0      1.0       1.0       1.0
Kill_radius_fu           1.0        1.0      1.0       1.0       1.0
Kill_radius_ufu          1.0        1.0      1.0       1.0       1.0

Individual injury data
Individual_injuries       1
Individual_injury         no_injury   1.0  -1.0  calm  docile  -1.0

suppressive_dose         6.0  5.0
expectation_time        20.0  20.0
suppression_radius      18.0  18.0

smoke_type              9
build_dest_radius       2.5
floor_dest_radius       3.0
he_power                -1
near_build_kill_prb     0.0
floor_kill_prb          0.0
in_build_kill_prb       0.65
```

ANNEX E
RN 2003/03
MAY 2003

TABLE E-I
SENSOR INDEX LISTING

Number - of – Sensors: 38

Sensor ID	Sensor Name
1.	Eye_ball
2.	Null_IDF_sight
3.	x10_Binoculars
4.	Vision_block
5.	Blue_C79_rifle_sight
6.	Blue_x10_sniper_sight
7.	Blue_x3_Eryx_sight
8.	Blue_x3_CARLG_sight
9.	Blue_x13TUA_sight
10.	Blue_x12_TUA_TI sight
11.	Blue_x7AFV_sight
12.	Blue_x1.5_Grizzly_sight
13.	Blue_x4_AFV_sight
14.	Blue_x10 Cougar_sight
15.	Blue_x5.8_Cougar_II sight
16.	Blue_x4 LEO_sight
17.	Blue_x14 LEO_sight
18.	Blue_x4_Leo_II sight
19.	Blue_LEO_TI_sight
20	Blue_NODLR_TI sight
21	Red_x4_Sniper_sight
22.	Red_x 3 6 HMG_sight
23.	Red_x 2.6_vehicle_sight
24.	Red_x 2.7_AGS_sight
25	Red_x6 BMP1_sight
26.	Red_x6 7 BMP1_II sight
27.	Red_x4 BMP2_sight
28	Red_x6 BMP2_sight
29.	Red_x 9.2_BMP2_TI sight
30.	Red_x5 BMP3_sight
31.	Red_x8_BMP3_sight
32.	Red_x5.5_BMP3_TI sight
33.	Red_x5.1_T 72/80 sight
34	Red_x12_T72/80_sight
35.	Red_T72/80_TI
36.	Red_x10_AT4/5_sight
37.	Red_x6_AT7_sight
38.	Red_x10 AT 14_sight

ANNEX F
RN 2003/03
MAY 2003

EXAMPLES OF SENSOR DATA FILES

```
Sensor_generic_file     B_C79_RIFLE_SIGHT

Sensor_type             optical_sight
Sensor_usage            Monocular
Sensor_transferable     FALSE
Sensor_max_speed        1.9
Sensor_max_distance     2500
Sensor_value            0.0
Flash_data_id           2
Number_of_settings      1
Setting_1_data          1.0
Sensor_fkill            True
Sensor_mag              3.4
Sensor_FOV_az           0.140
Sensor_FOV_el           0.140
Sensor_trans            0.9
Surv_weighting          0.1
Surv_use_time           6.0
Ta_priority_veh         1.0
Ta_priority_inf         1.0
Eye_piece_dia           0.028

Sensor_generic_file     NODLR_NFOV

Sensor_type             ti_scanning
acquire_static_target   TRUE
max_targ_td             10.0
max_mx_sp_fq            5.6
n_bar_det               1.0     0.5
n_bar_class             2.0     0.5
n_bar_recog             4.0     0.5
n_bar_ident             6.5     0.5
mrtdfile                urbsensors:mrtd_nodlr_nfov.dat
Sensor_usage            monocular
Sensor_transferable     FALSE
Sensor_max_speed        0.0
Sensor_max_distance     4850
Sensor_value            0.0
Flash_data_id           5
Number_of_settings      1
Setting_1_data          1
Sensor_fkill            True
Sensor_mag              11.94
Sensor_FOV_az           0.052
Sensor_FOV_el           0.035
Sensor_trans            0.75
Surv_weighting          1.0
Surv_use_time           15.0
Ta_priority_veh         0.5
Ta_priority_inf         0.5
Eye_piece_dm            0.039

Sensor_generic_file     PVS504
```

```
Sensor_type             II_sight
Gain_tolerance          0.0
Sensor_MTF_file         urbsensors:mtf_pvs504.dat
MTF_contrast_threshold 0.03
n_bar_det               1.0     0.6
n_bar_class             2.0     0.6
n_bar_recog             4.0     0.6
n_bar_ident             8.0     0.6
Sensor_usage            monocular
Sensor_transferable     FALSE
Sensor_max_speed        1.9
Sensor_max_distance     520.0
Sensor_value            0.1
Flash_data_id           2
Number_of_settings      1
Setting_1_data          1
Sensor_fkill            FALSE
Sensor_mag              1
Sensor_FOV_az           0.698
Sensor_FOV_el           0.698
Sensor_trans            0.8
Surv_weighting          2.0
Surv_use_time           5.0
Ta_priority_veh         2.0
Ta_priority_inf         2.0
Eye_piece_dm            0.02
```

ANNEX G
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TABLE G-I
AMMO INDEX LISTING

Number – of - Ammos: 75

Ammunition ID	Ammunition Name
1.	B_60mm_mortar_HE
2.	B_81mm_mortar_HE
3.	R_82mm_mortar_HE
4.	B_120mm_mortar_HE
5.	R_120mm_mortar_HE
6.	R_120mm_mortar_HE FRAG
7	R_120mm_mortar_HE RAP
8.	B_60mm_mortar_SMK
9	B_81mm_mortar_SMK
10.	R_82mm_mortar_SMK
11.	B_120mm_mortar_SMK
12.	R_120mm_mortar_SMK
13.	B_60mm_mortar_ILL
14.	B_81mm_mortar_ILL
15.	R_82mm_mortar_ILL
16.	B_120mm_mortar_ILL
17.	R_120mm_mortar_ILL
18.	B_105mm_how_HE
19.	B_105mm_how_SMK
20.	B_105mm_how_ILL
21.	R_122mm_how_HE
22.	R_122mm_how_SMK
23.	R_122mm_how_ILL
24.	R_152mm_how_HE
25.	R_152mm_how_SMK
26.	R_152mm_how_ILL
27.	B_155mm_how_HE
28.	B_155mm_how_SMK
29.	B_155mm_how_ILL
30	R_5.45mm_bullet
31.	B_5.56mm_bullet
32.	B_7.62mm_bullet
33.	R_7.62mm_bullet
34.	B_12 7mm_bullet
35.	R_12.7mm_bullet
36:	R_14.5mm_bullet
37.	R_30mm_AGS_17_grenade
38.	B_40mm_M203_grenade
39.	R_40mm_grenade

Ammunition ID	Ammunition Name
40.	B_hand_grenade
41.	R_hand_grenade
42.	B_smoke_grenade
43.	R_smoke_grenade
44.	R_73mm_BMP1_HE FRAG
45.	R_125mm_HE FRAG
46.	B_25mm_HEIT
47.	R_30mm_BMP2_HEI
48.	R_30mm_BMP3_HEI
49.	B_25mm_APDST
50.	R_30mm BMP2_AP-T
51.	R_30mm_BMP3_APDST
52.	R_73mm_BMP1_HEAT
53.	R_125mm_HEAT
54.	B_76mm COUGAR_HESH
55.	B_105mm_LEO_HESH
56.	B_105mm_LEO_APFSDS
57	R_125mm_APFSDS
58.	R_100mm_BMP3_HE FRAG
59.	B_M72_HEAT
60.	B_CARLG_HEAT
61.	R_RPG16_HEAT
62.	R_RPG18_HEAT
63	B_ERYX_missile
64.	B_TOW 11A_missile
65.	R_AT3_missile
66.	R_AT4_RM1112_missile
67.	R_AT4_RM111M_missile
68	R_AT5_missile
69.	R_AT7_missile
70.	R_AT10_missile
71	R_AT11_missile
72 .	R_AT14_missile
73.	B_CLAYMORE
74.	B_TRIPFLARE
75.	R_TRIPFLARE

ANNEX H
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EXAMPLES OF AMMUNITION DATA FILES

```
Ammo_generic_file       B_556mm_Bullet
ammo_type               bullet
Possession_prob         1.0
ammo_transferable       False
ammo_disarm_mode        on_disarm_disable
ammo_infantry_kill      True
ammo_optical_los        False
ammo_soft_los           False
ammo_hard_los           False
ammo_kill_all_floors    False
number_armoured_targets   0
skirmish                True
immunity_id             1
oxygen_provision        0
allowed_unit_subsets    0

Ammo_generic_file       B_105MM_HE_NEXTGEN
ammo_type               he_nextgen
possession_prob          1.0
ammo_transferable       False
ammo_disarm_mode        On_disarm_disable
ammo_infantry_kill      True
ammo_optical_los        False
ammo_soft_los           False
ammo_hard_los           False
ammo_kill_all_floors    True
number_armoured_targets   0
skirmish                FALSE
immunity_id             1
oxygen_provision        0
allowed_unit_subsets    0


Ammo_generic_file       B_105mm_LEO_APFSDS
ammo_type               AP_warhead
Possession_prob         1.0
ammo_transferable       False
ammo_disarm_mode        on_disarm_disable
ammo_infantry_kill      False
ammo_optical_los        True
ammo_soft_los           False
ammo_hard_los           False
ammo_kill_all_floors    False
number_armoured_targets   10
52 T72ERA
53 T72
54 T80U
55 BTR70
56 BTR80
57 BRDM2
```

```
58 BMP1
59 BMP2
60 BMP2ERA
61 BMP3
skirmish                False
immunity_id             1
oxygen_provision        0
allowed_unit_subsets    0


Ammo_generic_file       B_60mm_Mortar_SMK
ammo_type               Smoke_warhead
Possession_prob           1
ammo_transferable       False
ammo_disarm_mode        on_disarm_disable
ammo_infantry_kill      False
ammo_optical_los        False
ammo_soft_los           False
ammo_hard_los           False
ammo_kill_all_floors    False
number_armoured_targets   0
skirmish                FALSE
immunity_id             1
oxygen_provision        0
allowed_unit_subsets    0

Ammo_generic_file       B_60mm_MORTAR_ILL
ammo_type               Flare_warhead
point_flare             False
possession_prob         1.0
ammo_transferable       FALSE
ammo_disarm_mode        on_disarm_disable
ammo_infantry_kill      FALSE
ammo_optical_los        FALSE
ammo_soft_los           FALSE
ammo_hard_los           FALSE
ammo_kill_all_floors    FALSE
number_armoured_targets   0
skirmish                FALSE
immunity_id             1
oxygen_provision        0
allowed_unit_subsets    0
```

ANNEX I
RN 2003/03
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TABLE I-I
UNIT, WEAPON, SENSOR AND AMMUNITION SUMMARY

UNIT	UNIT SENSORS	WEAPONS	WEAPON SENSORS	AMMUNITION
Unit 1, B_60 mortar	Sensor 1, Eyeball	Wpn 1, 60mm mortar Wpn 8, C7 rifle Wpn 22, Hand	Sensor 1, Eyeball Sensor 5, C79 sight Sensor 1, Eyeball	Ammo 1, HE Ammo 8, SMK (WP) Ammo 13, ILLUM Ammo 31, 5 56 mm Ammo 40, HE grenade
Unit 2, B-81 mortar	Sensor 1, Eyeball	Wpn 2, 81mm mortar Wpn 8, C7 rifle	Sensor 1, Eyeball Sensor 5, C79 sight	Ammo2, HE Ammo 9, SMK (WP) Ammo 14, ILLUM Ammo 31, 5 56 mm
Unit 3, B-120 mortar	Sensor 2, Null	Wpn 3, 120mm mortar	Sensor 2, Null	Ammo 4, HE Ammo 11, SMK(WP) Ammo 16, ILLUM
Unit 4, B-LEI-How	Sensor 2, Null	Wpn 4, 105mm How	Sensor 2, Null	Ammo 18, HE Ammo 19, SMK Ammo 20, ILLUM
Unit 5, B_105C3_How	Sensor 2, Null	Wpn 5, 105mm How	Sensor 2, Null	Same as Unit 4
Unit 6, B_105NIAI-How	Sensor 2, Null	Wpn 6, 105mm How	Sensor 2, Null	Same as Unit 4
Unit 7, B-109A3/A4 How	Sensor 2, Null	Wpn 7, 155mm SP How	Sensor 2, Null	Ammo 27, HE Ammo 28 SMK(HC) Ammo 29 ILLUM
Unit 8, B-Comd	Sensor 1, Eye Sensor 3, x7 Binoculars	Weapon 8, C7 rifle Weapon 22, hand	Sensor 5, C79 sight Sensor 1, Eye	Ammo 31, 5 56mm Ammo 42, SMK grenade
Unit 9, B-rifmn	Sensor 1, Eye	Weapon 8, C7 rifle Weapon 22, hand	Sensor 5, C79 sight Sensor 1, Eye	Ammo 40, HE grenade Ammo 42, SMK grenade
Unit 10, B-rifmn-M72	Sensor 1, Eye	Weapon 8, C7 rifle Weapon 22, hand Weapon M72 LAW	Sensor 5, C79 sight Sensor 1, Eye Sensor 8	Ammo 31, 5 56mm Ammo 40, HE grenade Ammo 59, 66mm HEAT
Unit 11, B_C9_Gnr	Sensor 1, Eye	Wpn 9, C9 LMG Wpn 22, hand	Sensor 1, Eye Sensor 1, Eye	Ammo 31, 5 56 mm Ammo 42, SMK
Unit 12, B_Grendrr	Sensor 1, Eye	Wpn 8, C7 rifle Wpn 23, M203 launcher	Sensor 5, C79 sight Sensor 1, Eye	Ammo 31, 5 56 mm Ammo 30, 40 mm grenade
Unit 13, B_ERYX_Gnr	Sensor 1, Eye	Wpn 20, ERYX Wpn 8, C7 rifle Wpn 22, hand	Sensor 7, x3 sight Sensor 5, C79 sight Sensor 1, eye	Ammo 63, ERYX missile Ammo 31, 5 56 mm Ammo 42 SMK grenade
Unit 14, B_C6_Grn	Sensor 1, Eye	Wpn 10, 7 62 C6, GPMG Wpn 22, hand	Sensor 1, Eye Sensor 1, Eye	Ammo 32, 7 62 mm Ammo 42, SMK Grenade
Unit 15, B_sniper	Sensor 1, Eye Sensor 3, x7 binoculars	Wpn 11, sniper rifle Wpn 22, hand	Sensor 6, x10 sight Sensor 1, Eye	Ammo 32, 7 62mm Ammo 42, SMK grenade
Unit 16, B_HMG_Gnr	Sensor 1, Eye	Wpn 13, 12 7mm HMG Wpn 8, C7 rifle	Sensor 1, Eye Sensor 5, C79 sight	Ammo 34, 12 7mm Ammo 31, 5 56mm
Unit 17, B_CARLG-Gnr	Sensor 1, Eye	Wpn 19, 84mm CARLG Wpn 8, C7 rifle Wpn 22, hand	Sensor 8, x3 sight Sensor 5, C79 sight Sensor 1, Eye	Ammo 60, 84 mm HEAT Ammo 31, 5 56mm Ammo 42, SMK grenade
Unit 18, B_FOO/MFC	Sensor 1, Eye Sensor 3, x7 binocular Sensor 20, NODLR(TI)	Wpn 8, C7 rifle Wpn 22, hand	Sensor 5, C79 sight Sensor 1, Eye	Ammo 31, 5 56mm Ammo 40, HE grenade Ammo 42, SMK grenade
Unit 19, B_RECCE_DET	Sensor 1, Eye Sensor 3, x7 binoculars	Wpn 8, C7 rifle Wpn 22, hand	Sensor 5, C79 sight Sensor 1, Eye	Ammo 31, 5 56 mm Ammo 42, SMK grenade
Unit 20, B_OBS_DET	Sensor 1, Eye Sensor 3, x7 binocular Sensor 20, NODLR (TI)	Wpn 8, C7 rifle Wpn 22, hand	Sensor 5, C7 sight Sensor 1, Eye	Ammo 40, HE grenade Ammo 42, SMK grenade

UNIT	UNIT SENSORS	WEAPONS	WEAPON SENSORS	AMMUNITION
Unit 21, B_LEOC1	Sensor 1, Eye Sensor 3, x7 bnos Sensor 4, vision block Sensor 16, x4 sight	Wpn 17, 105mm main tank gun Wpn 12, 7 62 coax GPMG	Sensor 17, x14 sight (Sensor 18x4, II sight) Same as Wpn 17	Ammo 56, 105mm APFSDS Ammo 55, 105mm HESH Ammo 32, 7 62mm
Unit 22, B_LEOC2	Sensor 1, Eye Sensor 3, x7 binoculars Sensor 4, vision blocks Sensor 16, x4 sight	Wpn 17, 105mm main tank gun Wpn 12, 7 62 coax GPMG	Sensor 17, x14 sight (Sensor 19, x12 TI sight) Same as Wpn 17	Ammo 56k 105mm APFSDS Ammo 57, 10mm HESH Ammo 32, 7 62 mm
Unit 23, B-COUGAR	Sensor 1, Eye Sensor 3, x7 binoculars Sensor 4, vision blocks Sensor 11, x7AFV sight	Wpn 16, 76mm gun Wpn 12, 7 62 coax GPMG	Sensor 14 x10 sight (Sensor 15 x5 8 II sight) Same as Wpn 16	Ammo 54, 76mm HESH Ammo 32, 7 62mm
Unit 24, B-GRIZZLY	Sensor 1, Eye Sensor 3, x7 binoculars Sensor 4, vision block	Wpn 14, 12 7mm HMG Wpn 12, 7.62 coas GPMG	Sensor 12, x1 5 sight Same as Wpn 14	Ammo 34, 12 7 mm Ammo 32, 7 62 mm
Unit 25, B-BISON	Sensor 1, Eye Sensor 3, x7 binoculars Sensor 4, vision block	Wpn 12, 7 62 mm GPMG	Sensor 1, Eyeball	Ammo 32, 7 62 mm
Unit 26, B-NAPC	Sensor 1, Eye Sensor 3, x7 binoculars Sensor 4, vision blocks Sensor 11, x7AVF sight	Wpn 15, 25mm chain gun Wpn 12, 7 62 coax GPMG	Sensor 11, x7AFV sight (Sensor 13, x4TI sight) Same as Wpn 15	Ammo 49, 25mm APDST Ammo 46, 25 mm HEIT Ammo 32, 7 62 mm
Unit 27, B_COYOTE	Same as Unit 26	Same as Unit 26	Same as Unit 26	Same as Unit 26
Unit 28, B_M113A3	Sensor 1, Eye Sensor 3, x7 binoculars Sensor 4, vision blocks	Wpn 13, 12 7mm HMG	Sensor 1, Eye	Ammo 34, 12 7mm
Unit 29, B_TUA	Sensor 1, Eye Sensor 3, x7 binoculars Sensor 4, vision blocks	Wpn 21, TUA HAW Wpn 12, 7 62 coax GPMG	Sensor 9, x13 sight (Sensor 10, X12 TI) Same as Wpn 21	Ammo 64, TOW IIA Ammo 32, 7 62mm
Unit 30, R_82 mortar	Sensor 2, Null	Wpn 24, 82mm mortar Wpn 30, AK74 rifle	Sensor 2, Null Sensor 1, Eyeball	Ammo 3, HE Ammo 10, SMK Ammo 15, ILLUM Ammo 30, 5 45 mm
Unit 31, R_120 mortar	Sensor 2, Null	Wpn 25, 120mm mortar	Sensor 2, Null	Ammo 5, HE Ammo 12, SMK Ammo 17, ILLUM
Unit 32, R-2S1	Sensor 2, Null	Wpn 26, 122mm SP How	Sensor 2, Null	Ammo 21, HE Ammo 22, SMK Ammo23, ILLUM
Unit 33, R_2S3	Sensor 2, Null	Wpn 27, 152 mm SP How	Sensor 2, Null	Ammo 24, HE Ammo 25, SMK
Unit 34, R_2S9	Sensor 2, Null	Wpn 28, 120mm SP Mortar	Sensor 2, Null	Ammo 6, HE-FRAG Ammo 7, HE RAP Ammo 12, SMK
Unit 35, R_2S23	Sensor 2, Null	Wpn 29, 120mm SP Mortar	Sensor 2, Null	Ammo 6, HE-FRAG Ammo 7, HE RAP
Unit 36, R_Comd	Sensor 1, Eye Sensor 3, x7 binoculars	Wpn 30, AK74 rifle Wpn 53, hand	Sensor 1, Eye Sensor 1, Eye	Ammo 30, 5 45mm Ammo 41, HE grenade Ammo 43, SMK grenade
Unit 37, R_Rifmn	Sensor 1, Eye	Wpn 30, AK 74 rifle Wpn 53, hand	Sensor 1, Eye Sensor 1, Eye	Ammo 30, 5 45mm Ammo 41, HE grenade
Unit 38, R-RPK74-Gnr	Sensor 1, Eye	Wpn 31, RPK74 LMG Wpn 53, hand	Sensor 1, Eye	Ammo 30, 5 45mm Ammo 41, HE grenade
Unit 39, R_Grendr	Sensor 1, Eye	Wpn 30, AK74 rifle Wpn 38, 40mm launcher	Sensor 1, Eye Sensor 1, Eye	Ammo 30, 5 45 Ammo 39, 40mm grenade
Unit 40, R-RPG16, Gnr	Sensor 1, Eye	Wpn 30, AK74 rifle Wpn 45, RPG16 MAW Wpn 53, hand	Sensor 1, Eye Sensor 1, Eye Sensor 1, Eye	Ammo 30, 5 45mm Ammo 61, HEAT Ammo 43, SMK grenade
Unit 41, R-rfmn-R18	Sensor 1, Eye	Wpn 30, AK74 rifle	Sensor 1, Eye	Ammo 30, 5 45mm

UNIT	UNIT SENSORS	WEAPONS	WEAPON SENSORS	AMMUNITION
		Wpn 44, RPG 18 LAW Wpn 53, hand	Sensor 1, Eye Sensor 1, Eye	Ammo 62, HEAT Ammo 43, SMK grenade
Unit 42, R_PKM_Gnr	Sensor 1, Eye	Wpn 33, PKM GPMG Wpn 53, hand	Sensor 1, Eye Sensor 1, Eye	Ammo 33, 7 62mm Ammo 43, SMK grenade
Unit 43, R_Sniper	Sensor 1, Eye	Wpn 32, 7 62 rifle Wpn 53, hand	Sensor 21, x4 telescope Sensor 1, Eye	Ammo 33, 7 62mm Ammo 43, SMK grenade
Unit 44, R-HMG-Gnr	Sensor 1, Eye	Wpn 35, 12 7mm HMG Wpn 30, AK74 rifle	Sensor 22, x3 6 sight Sensor 1, Eye	Ammo 35, 12 7mm Ammo 30, 5 45mm
Unit 45, R_AGS17-Gnr	Sensor 1, Eye	Wpn 30, AK74 rifle Wpn 37, AGS 17 launcher	Sensor 1, Eye Sensor 24, x2 7 sight	Ammo 30, 5 45mm Ammo 37, 30mm grenade
Unit 46, R_AT4_Gnr	Sensor 1, Eye	Wpn 30, AK74 rifle Wpn 48, AT-4 ATGM	Sensor 1, Eye Sensor 36, x10 sight	Ammo 30, 5 45 mm Ammo 66, RM111-2 missile Ammo 67, RM111-M missile
Unit 47, R_AT5_Gnr	Sensor 1, Eye	Wpn 30, AK74 rifle Wpn 49, AT-5 ATGM	Sensor 1, Eye Sensor 36, x10 sight	Ammo 30, 5 45mm Ammo 68 AT-5 missile
Unit 48, R_AT7-Gnr	Sensor 1, Eye	Wpn 30, AK74 rifle Wpn 51, AT-7 ATGM	Sensor 1, Eye Sensor 37, x6 sight	Ammo 30, 5 45mm Ammo 69, AT-7 missile
Unit 49, R_AT-14_Gnr	Sensor 1, Eye	Wpn 30, AK74 rifle Wpn 52, AT-14 ATGM	Sensor 1, Eye Sensor 38, AT-14 sight	Ammo 30, 5 45mm Ammo 72, AT-14 missile
Unit 50, R_Recce_Det	Sensor 1, Eye Sensor 3, x7 binoculars	Wpn 30, AK74 rifle Wpn 53, hand	Sensor 1, Eye Sensor 1, Eye	Ammo 30, 5 45mm Ammo 43, SMK grenade
Unit 51, R_MORCOp	Sensor 1, Eye Sensor 3, x7 binoculars	Wpn 30A, K74 rifle Wpn 53, hand	Sensor 1, Eye Sensor 1, Eye	Ammo 30, 5 45mm Ammo 41, HE greande Ammo 43, SMK grenade
Unit 52, R_T72-ERA	Sensor 1, Eye Sensor 3, x7 binoculars Sensor 4, vision blocks Sensor 33, x 5 1 sight	Wpn 43, 125mm gun Wpn 34, 7 62 coax MMG	Sensor 34, x12 sight (Sensor 35, x12 TI)	Ammo 45, HE FRAG Ammo 53, HEAT Ammo 57, APFSDS Ammo 71, ATII missile Ammo 33, 7 62mm
Unit 53, R_T-72	Sensor 1, Eye Sensor 3 x7 binoculars Sensor 4, Vision blocks Sensor 33, x5 1 sight	Wpn 43, 25 mm gun Wpn 34, 7 62 coax MMG	Sensor 34, x12 sight Same as for Wpn 43	Ammo 45, HE FRAG Ammo 53, HEAT Ammo 57, APFSDS Ammo 33, 7 62mm
Unit 54, R_T-80U	Same as for Unit 52	Same as for Unit 52	Same as for Unit 52	Same as for Unit 52
Unit 55, R_BTR70	Sensor 1, Eye Sensor 3, x7 binoculars Sensor 4, vision blocks	Wpn 36, 14 5 Veh HMG Wpn 34, 7 62 coax MMG	Sensor 23, x 2.6 sight Sensor 23, x2 6 sight	Ammo 36, 14 5mm Ammo 33, 7 62mm
Unit 56, R_BTR80	Same as for Unit 55	Same as for Unit 55	Same as for Unit 55	Same as for Unit 55
Unit 57, R_BRDM2	Same as for Unit 55	Same as for Unit 55	Same as for Unit 55	Same as for Unit 55
Unit 58, R_BMP1	Sensor 1, Eye Sensor 3 x7 binoculars Sensor 4, vision blocks Sensor 25, x6 sight	Wpn 41, 73mm gun Wpn 47, AT-3 ATGM Wpn 34, 7 62 coax MMG	Sensor 25, x 6 sight (Sensor 26 X6 7 II sight) Sensor 25, x6 sight Same as Wpn 41	 Ammo 52, HEAT Ammo 65, AT-3 missile Ammo 33, 7 62 mm
Unit 59, R_BMP2	Sensor 1, Eye Sensor 3, x7 binoculars Sensor 4, vision blocks Sensor 27, x4 sight	Wpn 39, 30mm gun Wpn 50, AT5 ATGM Wpn 34, 7 62 coax MMG	Sensor 28, x6 sight (Sensor 29, x9 2TI) Same as Wpn 39 Same as Wpn 39	Ammo 47, HE-T Ammo 50, AP-T Ammo 68, AT5 missile Ammo 33, 7 62mm
Unit 60, R_BMP2_ERA	Same as Unit 59	Same as Unit 59	Same as Unit 59	Same as Unit 59
Unit 61, R_BMP3	Sensor 1, Eye Sensor 3, x7 binoculars Sensor 4, Vision blocks Sensor 30, x5 sight	Wpn 42, 100mm cannon Wpn 40, 30mm gun Wpn 34, 7 62 coax MMG	Sensor 31 x8 sight (Sensor 32, x5 5 TI) Same as Wpn 42 Same as Wpn 42	Ammo 58, HE FRAG Ammo 70, AT10 missile Ammo 48, HE-I Ammo 51, APDS-T Ammo 33, 7 62 mm
Unit 62, B_Claymore	Sensor 1, Eyeball	Wpn 54, Claymore	Sensor 1, Eyeball	Ammo 74, HE
Unit 63, B_Trip flare	Sensor 39, trip sight	Wpn 55, trip flare	Sensor39, minor sensor	Ammo 73, Flare
Unit 64, R-Tripflare	Sensor 39, trip sight	Wpn 55, trip flare	Sensor 39, minor sensor	Ammo 73, Flare

Note: Weapons sensors in brackets denote night or limited visibility sensors.

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This publication contains the documentation for the ORD CAEn Version 2.0 unclassified database. The document contains all the notes, assumptions, methodology and references relevant to the development of Version 2.0 database. The Canadian Version 2.0 CAEn database is valid for versions 2, 3, 5 and 8.1 of the British developed CAEn simulation software.

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